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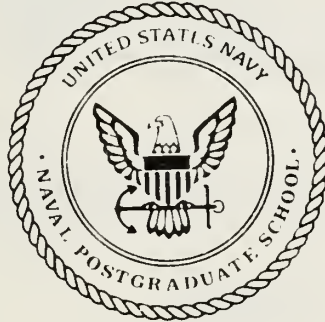
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NAVAL POSTGRADUATE SCHOOL

Monterey , California



THESIS

ALLOCATING THE INCREASED OPERATIONAL COSTS IN
RETAIL PRICES AT THE DEFENSE ELECTRONICS
SUPPLY CENTER AS A RESULT OF DEFENSE
MANAGEMENT REPORT DECISION 901

by

Michael G. Ahern

June 1991

Thesis Advisor:

Alan W. McMasters

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Allocating the Increased Operational Costs in Retail
Prices at the Defense Electronics Supply Center as
a Result of Defense Management Report Decision 901

by

Michael G. Ahern
Lieutenant Commander, United States Navy
B.S., John Carrol University, 1979

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

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ABSTRACT

Defense Management Review Decision (DMRD) 901 requires inventory control points managing Department of Defense (DoD) stock-funded material to include all the costs of doing business in the stock fund surcharge. The inventory control points will no longer receive direct operational and maintenance (O&M) funding in the defense budget. As a result of DMRD 901, for fiscal year 1991, the Defense Electronics Supply Center (DESC) must recoup, through its operational surcharge, \$84.1 million of its own operational costs and \$100.9 million of DLA Headquarters and support activity costs (a total of \$185.0 million). The increased surcharge has significantly raised the retail price DESC's customers must now pay for material requisitioned. This thesis will present alternative methods for allocating costs by changing the allocation base and examine the use of a fixed order charge to determine their effect on the retail prices of material.

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I. INTRODUCTION

A. PURPOSE

The purpose of this thesis is to explore alternative methods to recoup the operational costs the Defense Electronics Supply Center (DESC) must now include in the price of line items it charges to its customers as a result of Defense Management Report Decision 901 (DMRD 901). Because of DMRD 901, the costs requiring recoupment by the inventory control point's surcharge have increased substantially. The result is a substantial increase in the retail price a customer pays for DESC line items.

The present method DESC uses to recoup operational costs is a flat percentage surcharge applied to all line items held in inventory. This percentage is computed from the total annual forecasted cost of operations that will be required to be recouped and the forecasted cost of total annual sales. The annual costs are divided by the forecasted cost of sales to determine a surcharge percentage to increase the price of line items in order to recoup operational costs. The surcharge formula is:

$$\frac{\text{Forecasted Annual Costs}}{\text{Forecasted Annual Sales at Cost}} = \text{Surcharge.}$$

The basis for allocating costs illustrated above is the direct cost of materials. This method follows generally accepted accounting principles. However, it is not the only correct method for allocating costs. There is considerable latitude within generally accepted accounting principles for the allocation of costs.

The process for allocating costs involves two steps. The first step is to allocate costs to the responsibility centers (for our purpose DESC represents a responsibility center and Defense Logistics Agency (DLA) headquarters determines what costs are allocated to DESC) and the second step is allocating those costs to some measure of a center's output. The most common measures for allocating costs are direct material costs or direct labor costs incurred, direct labor hours or machine hours consumed and units of output such as requisitions filled. [Ref. 1:pp. 93-103]

Presently, DLA or DESC does not have the required accounting procedures to allocate costs by labor hours consumed and machine hours are not applicable to DESC [Ref. 2].

This leaves two measures for allocating the costs to be recouped; the cost of direct material or units of output. For DESC's purposes, the cost of direct material is represented by the purchase price of a line item and units of output are represented by the number of requisitions processed. A variety of possibilities exist for allocating costs using units of output. For example, costs can be

allocated per requisition or per frequency of requisitions in a dollar value range or a fixed order cost can be used to recoup a portion of the operational costs.

B. SCOPE

The scope of the thesis will be limited to the operations of DESC. Not all possible methods for allocating costs will be examined. Only those methods for which the author could obtain the required data to compute the sales price will be examined. Three basic models for cost allocation will be presented: the DESC model, the units of output model and the variable surcharge model. Further analysis is then conducted to ascertain what an economically feasible fixed order should be for DESC and to study the effect of various values of the fixed order cost on the retail price of line items.

C. ORGANIZATION

This thesis is divided into five chapters. Chapter I provides the purpose, scope and organization of the thesis. Chapter II provides the background information on the role of DLA, DESC, the history behind DMRD 901, and how Department of Defense stock funds and surcharges are administered. Chapter III presents the models for recouping DESC's operational costs and determining unit line item retail prices. These include the DESC model, the units of output model and the variable surcharge model. Two of these

models, the DESC model and the variable surcharge model, are then modified to allow a \$5.00 and \$10.00 fixed order charge. Chapter IV addresses each model's advantages and disadvantages and discusses the problems associated with implementing the models. Chapter V presents a summary of the thesis and conclusions and recommendations.

II. BACKGROUND

A. THE DEFENSE LOGISTICS AGENCY

The Defense Logistics Agency (DLA) is a Department of Defense (DoD) Agency whose mission is "to provide effective and economical support to the Military Services, other DoD components, Federal Civil Agencies, foreign governments and others as authorized" [Ref. 3:p. 5]. It was originally established as the Defense Supply Agency in 1961. Due to its ever expanding mission it was renamed in 1977 as the Defense Logistic Agency. [Ref. 3:p. 5]

The DLA plays a pivotal role in logistically supporting the Department of Defense. The agency manages over 2.8 million line items of supply. It has five supply centers that have inventory management responsibility over the items. The items are grouped into specific commodity classes such as construction, electronic, fuel, general supply items, industrial supplies, and personnel support items. The actual material is distributed between six depots managed by DLA and additional supply activities managed by the military services. The agency has over 50,000 military and civilian personnel attached to its worldwide operations. [Ref. 3:p. 5]

In addition to the mission of supplying material, the agency has an extensive contract management function which

is responsible for numerous regional and local contract administrative offices worldwide. The agency operates the technical supply and cataloging function for the military services, the Defense Industrial Plant Equipment Center, the Defense Standardization and Value Engineering Programs, and the Defense Reutilization and Marketing Service at the Battle Creek, Michigan, Supply Center. DLA is also the designated manager of the National Defense Stockpile (the national reserve of strategic materials stored in the event of war or a national emergency). [Ref. 3:p. 5]

B. THE DEFENSE ELECTRONICS SUPPLY CENTER

The Defense Electronics Supply Center (DESC), established in 1962, is a DLA inventory control point. DESC has two primary missions: to provide customers prompt, effective and reliable electronics spare parts support and to provide engineering support by standardizing electronic parts and encouraging their use in new designs. DESC manages over one million line items which represent 35 percent of all DLA items. The line items are all consumable; no repairable items are managed. Examples of line items managed by DESC are: resistors, connectors, transformers, antennas, crystals, switches, microcircuits, etc. [Ref. 3:p. 7]

The center does not store any material at its location in Dayton, Ohio. All material is either stored in one of the various DLA depots or a military service depot.

DESC supports over 20,000 military and civilian agency customers. DESC's customer base is 23 percent Army, 37 percent Navy, 33 percent Air Force and three percent Marine Corps. The remaining four percent customer base is from a variety of sources such as the Coast Guard, Foreign Military Sales and various government agencies. [Ref. 3:p. 7]

C. HISTORY OF DEFENSE MANAGEMENT REPORT DECISION 901

Throughout the last two decades there have been numerous initiatives to improve management in the Department of Defense (DoD). These initiatives have been in the form of studies, commissions and actual legislation. Some were specifically directed at DoD and some were directed at the Federal Government as a whole. The highlights of three of the more well-known initiatives are considered next.

In 1977, President Carter initiated the Defense Resource Management Study (DRMS). The President requested a "searching organizational review" of several DoD management issues [Ref. 4:p. 5]. One of the key management issues to be reviewed was the logistic support of combat forces. This issue of the became known as the "Rice Study," named for the present Secretary of the Air Force Donald B. Rice. In 1977, Rice was appointed as the DRMS study director. Rice

presented five case studies exploring logistics support alternatives for various weapon systems. Four principles which emerged from the case studies are: [Ref. 4:p. 6]

- Focus the maintenance capability of combat units on quick-turnaround repair.
- Consolidate off-equipment maintenance at a level that permits capture of economies of scale and reduces the vulnerability of some support resources.
- Give theater or fleet commanders the capability to reallocate support resources across combat units.
- Reduce, but not eliminate, the dependence of combat units on the CONUS wholesale structure for both maintenance and supply support in order to make the theater somewhat more self-sufficient.

President Reagan initiated the President's Private Sector Survey (PPSS) in 1983. The President requested a "thoroughgoing survey of the Federal Government's operations to identify opportunities for cost savings and improved management efficiencies" [Ref 5:p. 1]. J. Peter Grace chaired the PPSS Commission (which came to be commonly called the Grace Commission) and reported back to the President on January 12, 1984 with 2478 separate recommendations which, if implemented, were projected to save the Federal Government \$424.4 billion over the next three years. [Ref. 5:p. 1]

The Goldwater-Nichols Department of Defense Reorganization Act of 1986 mandated major changes in leadership, organization, training, planning and operation within DoD. The act created a more independent chairman of the Joint

Chiefs of Staff and increased the power and authority of the Commanders-in-Chief of the unified and specified commands.

These studies, commissions and legislation all had varying degrees of success implementing their recommendations but none would impact the Department of Defense like the President's "Blue Ribbon Commission on Defense Management." It is also referred to as the "Packard Commission" (named after its chairman David Packard, the well-renowned industrialist).

After a litany of reports of repair parts overpricing, major weapons systems procurement costs skyrocketing over budget, and systemic managerial problems within the Department of Defense, President Reagan sought a remedy to correct these problems. Therefore, on July 15, 1985, the President signed Executive Order 12526 which established the "Blue Ribbon Commission on Defense Management." As stated in the order,

The primary objective of the Commission shall be to study defense management policies and procedures, including the budget process, the procurement system, legislative oversight and the organizational and operational arrangements, both formal and informal, among the Office of the Secretary of Defense, the Organization of the Joint Chiefs of Staff, the Unified and Specified Command system, the Military Departments, and the Congress. [Ref. 6:p. 1]

The Commission was comprised of 17 individuals all possessing highly qualified credentials in either private enterprise or government. The Commission completed their work in June 1986 and forwarded their report, titled "A

Quest for Excellence," to the President. The Commission made numerous recommendations that,

...if fully implemented, will help create an environment in which each DoD component can achieve even higher standards of performance by summoning forth the enthusiasm and dedication of every man and woman involved in accomplishing its mission. [Ref. 7:p 12]

It focused on the following four areas:

- National Security Planning and Budgeting.
- Military Organization and Command.
- Acquisition Organization and Procedures.
- Government-Industry Accountability.

Despite not specifically addressing logistics as an area for potential cost savings and improved management, the "Packard Commission" provided the backdrop for the Defense Management Report conceived during the Bush administration.

In February 1989, President Bush directed the Secretary of Defense to develop "a plan to improve the defense procurement process and management of the Pentagon" [Ref. 8:p. 1]. He desired a plan that would fully implement all of the recommendations of the "Packard Commission" and expand upon the scope of the Commission's recommendations to substantially improve the management of DoD in all areas. The Secretary of Defense, Dick Cheney, responded to the President's direction by writing the Defense Management Report. The report challenged each service and defense agency to continue implementing the recommendations of the "Packard Commission" and to seek additional methods for

improving management and reducing costs within DoD.

[Ref. 8:p. 1]

The report identified six broad areas where economies and efficiencies could be achieved in DoD. The six areas are: [Ref. 9:p. 6]

- To reduce overhead in DoD while maintaining military strength.
- To improve weapon systems' performance.
- To revitalize the department's planning, programming and budgeting process.
- To reduce micro-management.
- To strengthen the industrial base for defense initiatives in American industry.
- To improve the observance of ethical standards in government and industry.

The first area, reducing overhead in DoD, thrust all areas of logistics into the limelight for reducing costs. DoD's logistic infrastructure accounts for almost \$30 billion of the defense budget annually (for fiscal year 1991 this represents almost ten percent of the entire defense budget) and the total DoD inventory of supplies and repair parts is valued at approximately \$100 billion [Ref. 10:p. 3]. Thus, the sheer size of logistic-related investments and expenditures within DoD made logistics an area ripe for potentially substantial cost savings.

The services responded to the Defense Management Report with various initiatives which, when combined, could realize a savings of \$39.1 billion over the next five years.

Logistics bear the brunt of the savings to the amount of \$21.0 billion. The initiative issue, "Reducing Supply Systems Costs," was projected to save \$10.1 billion over the next five years (1991 to 1995) and impacts on all services and the Defense Logistic Agency. [Ref. 11:p. 33] The initiative description is provided below:

This initiative gives managers the visibility and flexibility to manage supply costs better. Operational costs will be moved into stock fund accounts, thereby enabling DoD to better control these costs in order to obtain savings in procurement costs. This will also ensure that the level of operational funding is tied to actual workload rather than to an estimate made 24 months earlier. Beginning in FY 1991, these operational costs will be reflected in stock fund surcharges paid by customers. Savings of three percent of total supply costs are anticipated due to this new ability to better control overall costs, and these savings have been reflected in the Services budgets. Reductions for the outyears will also be reflected in stock fund surcharges. [Ref. 10:p. 33]

Four additional policy changes designed to reduce supply system's costs are as follows: change inventory stockage policies in order to reduce transportation costs; increase the use of commercial items where service specifications can be eliminated; increase the use of multiple year contracts to improve material availability by reducing lead time; and permit DoD to fund technical data within stock fund accounts [Ref. 12:pp. 32-33].

Table 1 illustrates the total five-year savings expected to be realized by the service or agency through implementation of the initiative. [Ref. 12:p. 32]

TABLE 1

EXPECTED SAVING FROM REDUCING SUPPLY SYSTEM'S COSTS
(DOLLARS IN MILLIONS)

<u>SERVICE/AGENCY STOCK FUND</u>	<u>SAVINGS FY 1991</u>	<u>SAVINGS FY 92-95</u>	<u>TOTAL SAVINGS</u>
ARMY	\$56.0	\$2,245.0	\$2,301.0
NAVY	116.0	2,437.0	2,553.0
AIR FORCE	63.0	2,029.0	2,092.0
DEFENSE AGENCIES	<u>194.0</u>	<u>3,002.0</u>	<u>3,196.0</u>
GRAND TOTAL	\$429.0	\$9,713.0	\$10,142.0

Once the initiatives were developed, they received additional scrutiny by teams working for the Secretary of Defense. The teams consisted of personnel from all services and agencies because the proposals crossed many areas of management within DoD. The issues and risks of implementing the initiatives and the projected cost savings were reviewed by the teams and minor adjustments or changes were made if required. Once the teams completed the review process the initiatives were signed by the Secretary of Defense and called Defense Management Report Decisions. Each decision was assigned a number and was to be implemented as soon as possible. The initiative titled "Reducing Supply Management Costs" became formally Defense Management Report Decision 901 (DMRD 901).

In addition to DMRD 901, the team formulated DMRD 971. DMRD 971 expanded upon DMRD 901 by establishing a DoD financial management system, "to realign costs with outputs in order to properly allocate costs to those who benefit the most--the customers of activities" [Ref. 13:p. 2]. Specific actions to be initiated as a result of DMRD 971 are listed below: [Ref. 13:p. 2]

- Establish a new revolving fund, the Defense Business Operations Fund (DBOF) on October 1, 1991.
- Include all current industrial and stock fund activities in the DBOF.
- Include a number of additional support business areas in the DBOF.
- Establish a new revolving fund, the Military Personnel Revolving Fund on October 1, 1991, which will include all of the costs required to support the military member as distinct from the unit.
- Include Capital Budgeting in both of the new revolving funds (i.e., funding of equipment and facilities for the businesses is to be part of the use of those funds, and recovery of the cost of those investments by including depreciation is allowed as a cost of doing business).
- Budget for the medical costs of future retirees on an actuarial basis.

The major effect of DMRD 901 on the Defense Electronics Supply Center was the requirement to place all operational costs into center's surcharge. These costs are to be passed on to the customer in the retail price of the material requisitioned. The customer will now be required to reimburse DESC for the following additional costs not previously included in surcharge: [Ref. 2]

- Operational costs of DESC.
- DLA depot costs incurred by DESC.
- Real property maintenance.
- DESC's portion of the Defense System's Operation Center (automatic data processing costs).
- DESC's portion of the Defense Logistics Studies Information Exchange services.
- DESC's military personnel costs.
- DESC's portion of the DLA's management support activities.

D. DEPARTMENT OF DEFENSE STOCK FUNDS

DoD stock funds are defined as revolving or working capital funds that enable various supplies to be sold to customers on a cash basis. The cash revenues received from sales are then reinvested in the purchase of additional stock to replenish inventories. Major customers purchasing supplies from the stock funds utilize their Operations and Maintenance (O&M) or industrial accounts to fund their purchases.

There are five separate stock funds established by charter and approved by the Assistant Secretary of Defense (Comptroller) in DoD. These are: DLA, Navy, Air Force, Army and the Marine Corps stock funds. Each of these stock funds can sell supplies to DoD customers, other DoD stock funds, (non-DoD) government customers, and various foreign governments via the Foreign Military Sales Program. [Ref. 14:p. G10]

The initial funding for DoD stock funds is not provided by Congressional appropriations. The initial stock fund "corpus" or body of capital is established by the Secretary of the Treasury. The amount of the "corpus" is determined by the anticipated levels of inventory required to support customers who, in turn, reimburse the stock fund with their purchases. In day-to-day operations stock funds "operate with obligational authority approved within the Executive Branch by the Office of Assistant Secretary of Defense (Comptroller) and the Office of Management and Budget" [Ref. 15:p. 1-1]. However, stock funds receive periodic injections of appropriated funds for two specific types of inventory increases: war reserve and certain peacetime inventory augmentations. Examples of peacetime augmentations are: stocks required to support force growth and modernization, major weapon systems modification programs and programs to improve readiness. [Ref. 14:p. G3]

The various stock funds within DoD finance a wide variety of commodities including fuels, clothing, food, commissary items, medical and dental supplies, hardware and repair parts. The repair parts are broken into two levels of inventory: wholesale and retail. Wholesale inventories are designed to support world-wide DoD requirements and retail inventories are designed to support local customer requirements.

The largest of all the stock funds is the DLA fund which manages in excess of 2.8 million line items, more than half the total National Stock Numbers (NSNs) in DoD [Ref. 15:p 51]. This is expected to increase substantially as the individual services are required to turn over most of their consumable items to DLA for management. DMRD 926 requires the services, "to transfer management control of over one million spare parts to the Defense Logistics Agency" [Ref. 16:p. 23]. The transfer is expected to be completed by 1995. [Ref. 16:pp. 22-23]

Pricing of stock-funded material must follow the policies and procedures outlined in DoD Instruction 7420.13-R, Stock Fund Operations. The key points of the instruction's pricing policies are: [Ref. 17:p. 4-1]

- Each item with a NSN assigned, which is managed by a DoD Inventory Control Point, will have one standard price for all sales to DoD and Coast Guard customers.
- The standard price for a catalogued item managed by a DoD Inventory Control Point will be changed only at the beginning of the fiscal year and shall remain constant throughout the fiscal year. This does not apply for clothing or subsistence items.
- The last acquisition cost of a representative procurement will be the basis for establishing a standard price for an item.
- A surcharge will be included in the standard price to recover operating expenses incurred by a stock fund.

Each stock fund must utilize general ledger accounts and record accounting transactions on a double entry, accrual basis. The accounts must be updated at least monthly to

reflect the results of recording supply and accounting transactions. Each stock fund holder must develop balance sheets and income statements that properly reflect the fund's status. A simplified stock fund balance sheet is provided in Figure 1 below: [Ref. 14:p. G21]

SIMPLIFIED STOCK FUND BALANCE SHEET

ASSETS:	LIABILITIES:
Cash	Accounts payable
Accounts Receivable	
Inventory	CAPITAL:
Material-in-Transit	Fund Equity
	Cumulative Results

Figure 1. Simplified Stock Fund Balance Sheet

On the asset side of the balance sheet, "cash" represents the theoretical cash balance held in the centralized Treasury account. The "accounts receivable" represents material issued from inventory but the customer has not yet paid for it. The "inventory" represents the monetary value of all supplies held in stock and the "material-in-transit" consists of supplies paid for from the cash account but not yet received. [Ref. 18:pp. 55-56]

On the liability side of the balance sheet, "accounts payable" represents material received but not yet paid for from cash. Of the two capital accounts maintained, "fund

equity" represents the initial capitalization of the fund plus or minus any alterations made by Congress since the funds inception. "Cumulative results" represents gains or losses from operations. [Ref. 18:pp. 55-56]

E. STOCK FUND SURCHARGES

As previously explained, the stock fund is a "corpus" or set level of working capital. In the course of doing business stock funds incur expenses that directly relate to their purpose of providing supplies to their customers. In order to prevent the corpus or total capital amount of the stock fund from eroding over time a surcharge is added to the price of an item.

Prior to the implementation of DMRD 901, the amount of the surcharge was limited to only recovering the direct operating expenses incurred by the stock fund. The stock fund administrators were prohibited from including any supply administration expenses in the stock fund: [Ref. 17:p. 4-3]

The expense of procurement, warehousing, packing, crating, and handling, or any functions of supply administration pertaining to a stock fund item, may not be financed by a stock fund or included in the standard price of an item, but shall be charged to appropriations available for that purpose. [Ref. 17:p. 4-3]

This restriction on limiting the surcharge kept the size of the surcharge relatively small and made only a small impact on the retail price of the line item. Prior to DMRD

901 the surcharge consisted of the following elements:

[Ref. 14:pp. G6-G7]

1. TRANSPORTATION--Normally the cost of material purchased by the fund includes the cost of initial transportation from source of manufacture or purchase to its initial resting point at a storage point in the supply system. Additionally, if this material is relocated within the supply system, from one stock point to another, the stock fund must bear the cost of this transportation. Thus, in order for a stock fund to maintain its real worth, it must charge its customers not only for the cost of the material but also the cost of its initial and internal transportation.

2. PHYSICAL LOSSES OF MATERIAL--Since the stock fund is in the business of holding inventory until it is issued to a customer, it experiences a measure of damage or loss of the inventory in the process. Consequently, if the fund is going to revolve, it must pass the cost of replacing damaged or lost inventory on to its customers in the prices charged for material actually issued.

3. OBSOLESCENCE--Because the supply system and the stock fund are in the business of supporting customers and its method of operation is through the issuance of material from inventory (as opposed to simply ordering it from the commercial world when customers request material), stock funds buy most material for stock in anticipation of a level of customer requests and continue to support defense systems until their deactivation. As a consequence, some of the material bought by the stock fund is never sold to customers. This situation could come about because of erroneous anticipation of demand, technological improvements in the item, technological improvements in the customers system or the deactivation of whole customer systems. Thus, in order for a stock fund to maintain its real worth and continue to revolve, it must forecast these costs and recoup them from customers through the prices of the items it does sell to customers.

4. INFLATION--Since we live in a world of inflationary price increases, stock funds must recoup the cost of replacing its inventory (as opposed to its initial cost to buy the inventory) from its customers, in order to maintain the real worth of the stock fund and continue its business.

5. PRICE STABILIZATION--The price stabilization factor is the cash tool used to effect the budgeted rate

change across all material categories and to achieve the approved level of fund with the treasury. It is a buffer that compensates for the difference between pricing assumptions made in the budget and actual costs experienced during the preceding twelve months.

By not including the supply operational and administrative costs in the surcharge, now required by DMRD 901, the total surcharge for DESC would be 13.6 percent for fiscal year 1991 [Ref. 19:p. 1]. The percentages attributed to each surcharge element are as follows: transportation--2.7 percent; loss of material--6.1 percent; obsolescence--2.2 percent; inflation--3.8 percent; price stabilization--negative 1.2 percent. Figure 2 illustrates each cost element's contribution to make up the 13.6 percent inventory maintenance surcharge for fiscal year 1991. Each element's contribution in the figure has been adjusted for the negative price stabilization element.

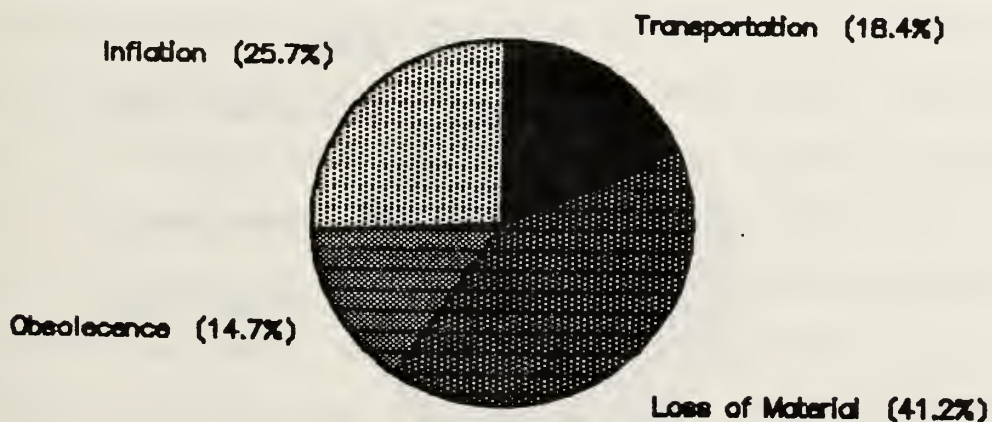


Figure 2. Contributions of the Elements of the DESC FY 1991 Surcharge without DMRD 901

However, DMRD 901 requires DESC to include all the costs of doing business in the center's surcharge in addition to the cost elements previously mentioned. For fiscal year 1991, DESC must include all their own operational costs and a proportion of DLA's total costs. The additional cost elements apportioned to DESC by DLA headquarters are: depot costs, real property maintenance costs, regional automatic data processing costs, technical services cost, military personnel costs and management support activity costs. DESC's own operational costs and the additional operational costs apportioned to DESC by DLA headquarters increases DESC's fiscal year 1991 surcharge by 30.6 percent. Combining all cost elements the total 1991 surcharge is 44.2 percent [Ref. 19:p. 1]. Figure 3 illustrates each cost element's contribution to make up the total 44.2 percent surcharge.

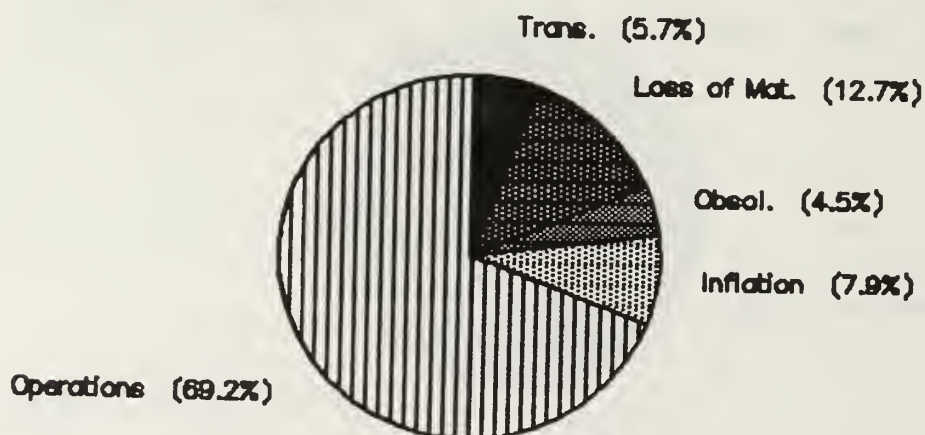


Figure 3. Contributions of the Elements of the DESC FY 1991 Surcharge Required by DMRD 901

III. COST ALLOCATION MODELS

The focus of this chapter is to present several different methods for allocating the operating costs that DESC must now recover from the retail price of line items. The first cost allocation method examined is based on the direct material costs. This is the method presently used by DESC and will be referred to by the author as the DESC model. The second method examines allocating costs as a function of units of output. For DESC's purposes, requisitions processed represents their units of output. The third method examined allocates costs as a function of the frequency of requisitions per a dollar price range. This method of cost allocation is referred to as the variable surcharge model.

In the fourth method the effect a fixed order charge has on the retail price of line items is considered. To determine an economically feasible fixed order charge for DESC, a number of private sector companies were surveyed that utilize a shipping and handling charge. The results of the survey are included in Appendix C. Although the actual shipping costs incurred to ship material to customers are not part of DoD stock points' cost, shipping and handling charges in the private sector are examined because, analogous to a fixed order charge, both are added to the retail

price of material to determine the total order cost. Both the DESC model's and the variable surcharge model's retail prices are recomputed as additional models having a fixed order charge.

A. DATA COLLECTION

In order to allocate costs by the various models, the following data were required: forecasted costs to be allocated, forecasted annual number of requisitions, a stratification of requisitions by line item price and total dollar value of sales by line item price. The procedure the author used for collecting data is provided below.

1. The Forecasted Costs to be Recouped as a Result of DRMD 901

The forecasted costs to be recouped by DESC for fiscal year 1991 were provided by DLA headquarters via a phone call. [Ref. 2]

2. Forecasted Cost of Sales

DESC fiscal year 1991 forecasted cost of sales was provided via a phone call with DESC's budget officer. [Ref. 20]

3. Five-year Monthly Requisition History

The number of requisitions for fiscal year 1991 will be based on a forecast using DESC's prior five-year monthly requisition history provided by DESC's Supply Operations Department. The actual monthly data is provided in Appendix A.

4. Stratification of Fiscal Year 1990 Requisitions by Value of Line Item

DESC's supply operations branch provided the author with a stratification of total fiscal year 1990 requisitions based on the initial price of the line items. The stratification divides the all line items into the following dollar value ranges: \$0.01-1.00, 1.01-5.00, 5.01-10.00, 10.01-25.00, 25.01-50.00, 50.01-100.00, 100.01-500.00, 500.01-1000.00 and 1000.01 and up.

5. Total Dollar of Sales Volume Based on the Line Item Retail Price

DESC's supply operations branch also provided the author with a stratification of fiscal year 1990 sales volume. The stratification divides the sales volume into the same dollar value ranges provided above.

B. DESC MODEL: ALLOCATING COSTS AS A FUNCTION OF COST OF SALES

The DESC model replicates the computations DESC performed to determine the total surcharge rate for fiscal year 1991. After computing the surcharge, various line item price levels will be examined to determine the price increase attributed to the surcharge.

There are two distinct and separate components of the surcharge that, when summed, comprise the total surcharge. The first component is designed to recover the direct operating expenses of maintaining the stock fund inventories. The inventory maintenance surcharge elements are

transportation, physical losses of material, obsolescence, inflation and a price stabilization. These surcharge elements are the costs which have normally been associated with DoD stock fund surcharges.

For fiscal year 1991, DESC's current surcharge for recovering direct operating expenses incurred by maintaining stock fund inventories is 13.6 percent. This component of the stock fund surcharge will not be analyzed to determine if alternate methods are applicable for recouping funds within the stock fund because it falls out of the scope of DMRD 901. The 13.6 percent inventory maintenance surcharge will be added to the alternative cost allocation models presented throughout this chapter to comprise the total surcharge.

The second component of the surcharge are those cost elements included as a result of the DMRD. DMRD 901 requires that the stock fund holder must include all the costs of doing business in the surcharge.

DLA headquarters determines the operating costs DESC is to include in their surcharge computation. For fiscal year 1991 DLA headquarters requires DESC to include the forecasted operational costs listed in Table 2 in the surcharge computation. [Ref. 2]

TABLE 2

FY 91 DESC OPERATIONAL COSTS TO BE RECOUPED
(\$ in millions)

<u>COST CATEGORY</u>	<u>FY 91 COST</u>
DESC Operations	\$84.1
Depot costs	\$86.5
RPMR (Real Property Maintenance Reserve)	\$2.0
DSAC (Defense System Automation Center)	\$2.0
DLSC (Defense Logistics Services Center)	\$5.0
Military Personnel	\$2.0
Management Support Activities	\$3.4
	<hr/>
TOTAL COSTS	\$185.0

DESC computes the surcharge by dividing the total fiscal year 1991 cost of operations by the fiscal year 1991 forecasted cost of sales. DESC's budget officer's forecasted cost of sales for fiscal year 1991 is \$524 million. [Ref. 20] The result is a 35.3 percent surcharge to recover the DMRD 901 costs of operations. The following equation illustrates the surcharge computation.

$$\frac{185 \text{ million (cost of operations)}}{524 \text{ million (FY 91 cost of sales)}} = 35.3 \text{ percent . surcharge}$$

To determine the entire surcharge for fiscal year 1991, DESC adds the operational cost surcharge and the surcharge

incurred as a direct result of maintaining the stock fund inventories. The total surcharge amounts to 48.9 percent (35.3 percent plus 13.6 percent).

However, for fiscal year 1991, DESC's surcharge is only 44.2 percent. The difference results from a DLA policy to reduce total inventory levels. Presently DLA is not replacing all inventories on a one-for-one basis. The sale of line items that are not to be replaced offset a portion of the operational costs. This is only a one-time cost savings however. DLA can only use it temporarily to "soften" the impact of the increasing surcharge to the customer. To facilitate comparisons between the various models to be presented, the computed operational surcharge of 35.3 percent will be used for the DESC line item retail price computations.

DESC applies the surcharge equally to all line items in inventory regardless of price. Thus, the surcharge does not vary with the quantity of line items requisitioned by a customer. Line item retail prices are set prior to the beginning of the fiscal year [Ref. 17:p. 4-2].

Table 3 illustrates the sale price increase resulting from the DESC model surcharge on various line item price levels. The table uses the median price of each category of the price stratification, with the exception of the \$3,000.00 price. The \$3,000.00 was chosen only to

illustrate the effect of the surcharge on a high-cost line item.

TABLE 3

DESC MODEL: SURCHARGE EFFECT ON SALE PRICES

<u>PRICE STRATIFICATION</u>	<u>MEDIAN PRICE</u>	<u>13.6% SURCHARGE</u>	<u>35.3% SURCHARGE</u>	<u>RETAIL PRICE</u>
\$0.01-1.00	\$0.50	\$0.07	\$0.18	\$0.75
\$1.00-5.00	\$3.00	\$0.41	\$1.06	\$4.47
\$5.01-10.00	\$7.50	\$1.02	\$2.65	\$11.17
\$10.01-25.00	\$17.50	\$2.38	\$6.18	\$26.06
\$25.01-50.00	\$37.50	\$5.10	\$13.24	\$55.84
\$50.01-100.00	\$75.00	\$10.20	\$26.48	\$111.68
\$100.01-500.00	\$300.00	\$40.80	\$105.90	\$446.70
\$500.01-1000.00	\$750.00	\$102.00	\$264.75	\$1116.75
\$1000.01 & UP	\$3000.00	\$408.00	\$1059.00	\$4467.00

With the surcharge equally applied to all line items regardless of initial price, the amount of funds recouped per line item widely varies. An item which costs \$0.50 only contributes \$0.25 to the cost of operations whereas an item which costs \$3,000.00 contributes \$1,457.00. An interesting side issue is that for a requisition for a single item that has a retail price of \$0.75, the price increase of \$0.25 will not even cover the cost of postage to mail the item to the customer.

C. UNITS OF OUTPUT MODEL: ALLOCATING COSTS AS A FUNCTION OF UNITS OF OUTPUT

As discussed earlier, an alternative method for allocating operational costs applicable to DESC (and which follows generally accepted accounting principles) is to allocate costs to units of output. In this model the number of requisitions processed at an inventory control point is the measure of the unit of output. In order to allocate costs as a function of units of output two factors must be known: the forecasted number of yearly requisitions and costs to allocate. The forecasted fiscal year 1991 operational costs determined by DLA headquarters for DESC was \$185.0 million, as shown above. To determine DESC's number of yearly requisitions for fiscal year 1991, a forecast was made using the previous five years' monthly requisition history. Appendix A presents the actual five-year monthly requisition history for DESC and is the data used in the forecasting model.

The monthly requisition history is plotted in Figure 4. From examination of the figure it is evident that seasonality influences are present in the monthly requisition data. Figure 5 illustrates the annual total requisitions for each year. It is obvious that there is a decreasing trend factor in the figure. In order to provide an accurate forecast the forecasting model must take both of these factors into account.

DESC FY 86-90 MONTHLY REQUISITIONS

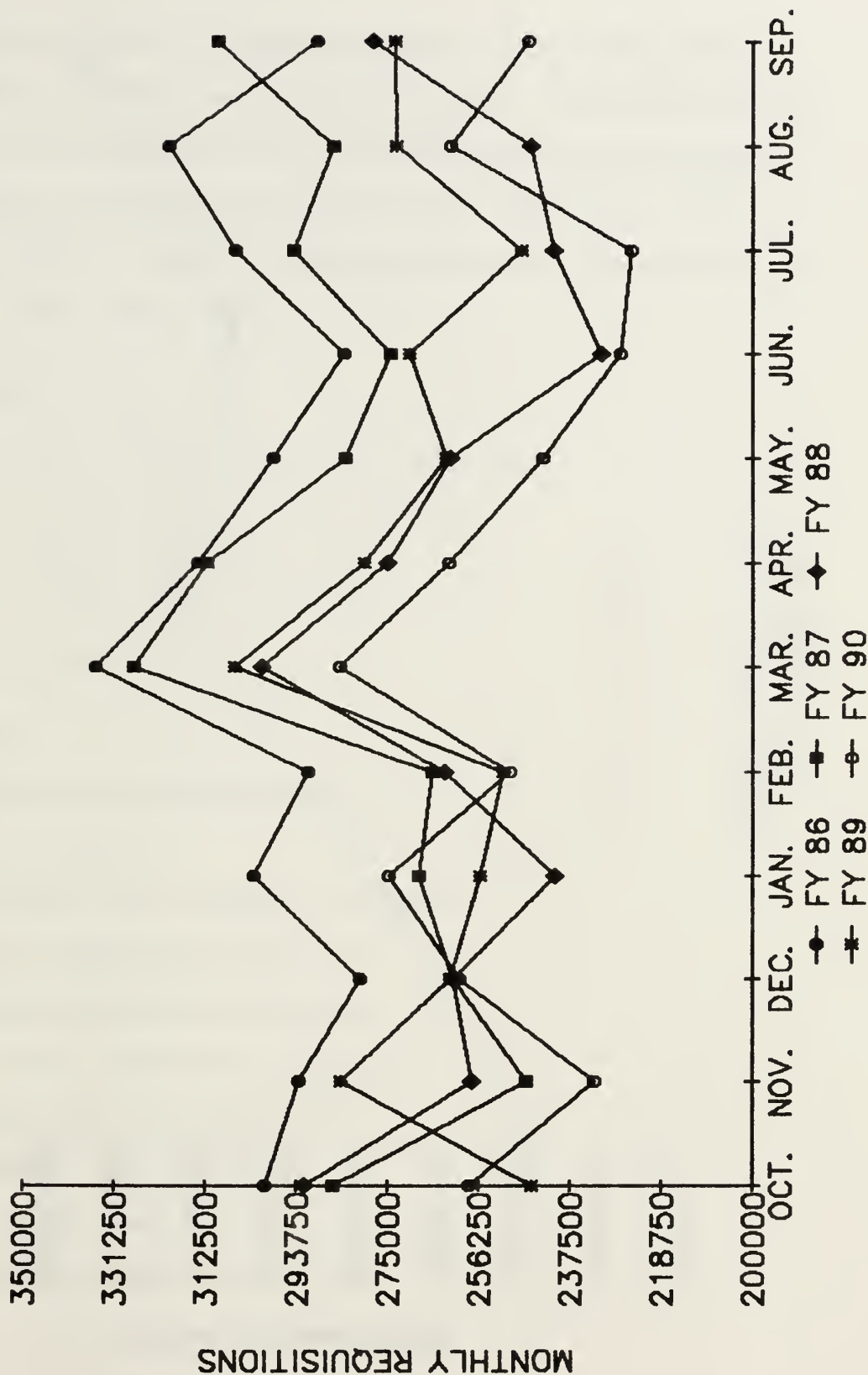


Figure 4. DESC's FY 86-90 Monthly Requisition History

DESC FY 86-90
YEARLY REQUISITIONS

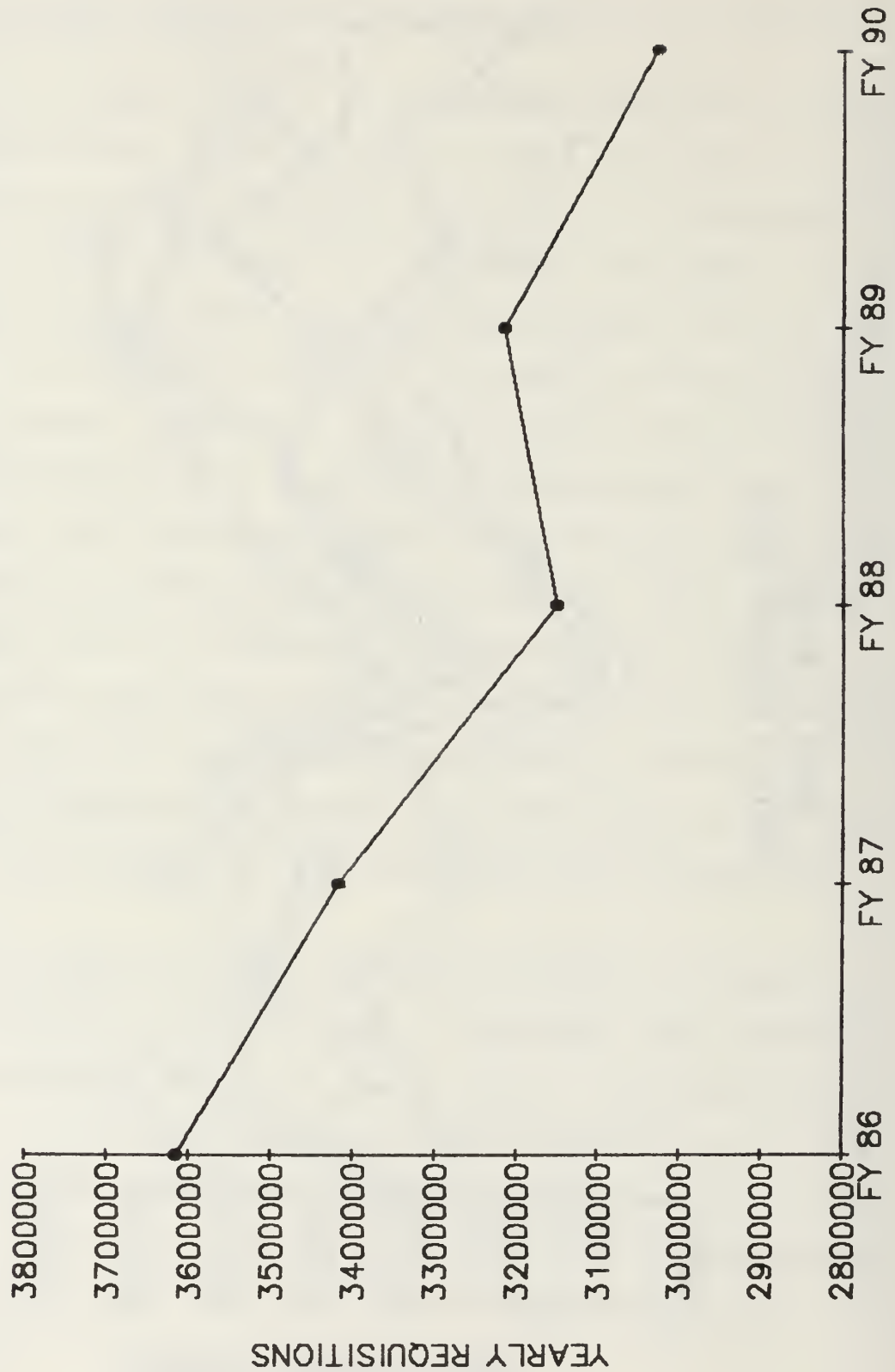


Figure 5. DESC's FY 86-90 Yearly Requisition History

The model used to forecast DESC's fiscal year 1991 requisitions is known as "Winter's Model." This model is an exponentially weighted moving average model that incorporates trend and seasonal factors in the forecast. The "Winter's Model" formulas and explanation of notation are as follows: [Ref. 21:p. 269]

FORMULAS

$$F(t) = \alpha A(t) / I(t-m) + (1-\alpha) (F(t-1) + T(t-1));$$

$$T(t) = \beta (F(t) - F(t-1)) + (1-\beta) T(t-1);$$

$$I(t) = \gamma A(t) / F(t) + (1-\gamma) I(t-m);$$

$$f(t+\tau) = (F(t) + \tau T(t)) I(t+\tau-m);$$

$$MAD = \sum_{t=1}^n |e(t)| / n.$$

NOTATION

t: time or period (months);

τ : time after t;

m: seasonal cycle length in months;

α : first smoothing parameter;

β : trend smoothing parameter;

γ : seasonal smoothing parameter;

A(t): actual data in period t;

f(t): forecast for period t;

T(t): trend for period t;

F(t): smoothed value for period t;

I(t): seasonality index for period t;

e(t): error for period t, which is f(t)-A(t).

The computer program QSB+ was used to search for the values of parameters α , β , and γ , which would result in the smallest MAD value [Ref. 21:p. 269]. The program results showed that the smallest MAD was 14,129 when $\alpha = 0.3$, $\beta = 0.050$ and $\gamma = 0.250$. The program's actual monthly forecasts for October 1986 through August 1991 are provided in Appendix B. The monthly forecasts are consecutively numbered as periods 1 through 72 in the appendix. Table 4 provides the last 12 monthly forecasts the model produced. These are for fiscal year 1991. The corresponding total number of forecasted requisitions is 2,805,737 for fiscal year 1991.

TABLE 4
DESC FY 91 MONTHLY REQUISITION FORECAST

<u>MONTH</u>	<u>FORECAST</u>
OCT	237,662
NOV	228,907
DEC	227,344
JAN	232,855
FEB	226,345
MAR	263,541
APR	244,167
MAY	229,169
JUN	217,985
JUL	224,695
AUG	240,735
SEP	<u>232,332</u>
TOTAL	2,805,737

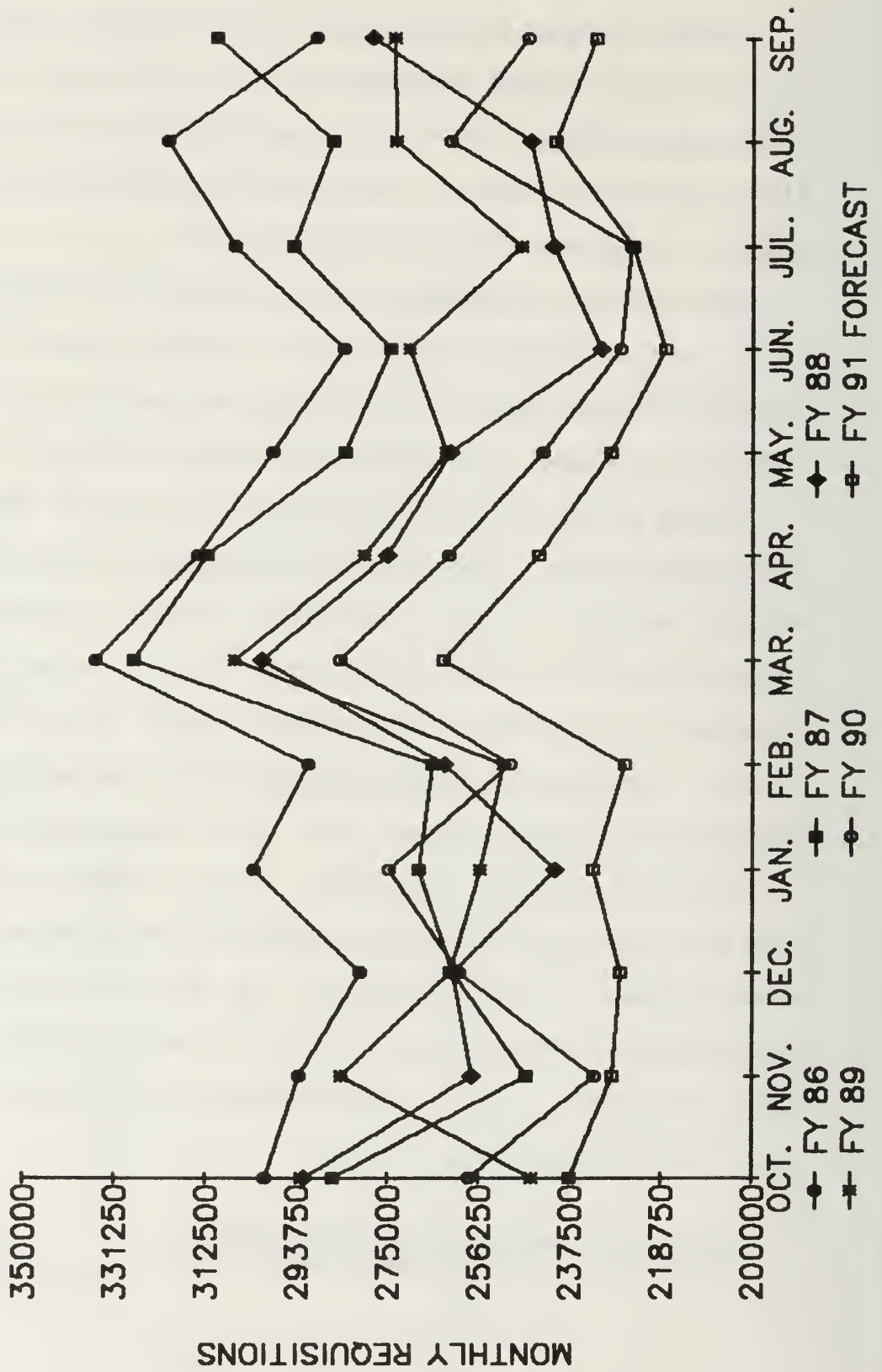
Figure 6 shows how well the model's fiscal year 1991 forecast is tracking the actual five-year historical monthly requisition data. Figure 7 plots DESC's first six months of fiscal year 1991 actual total monthly requisitions with the model's forecasts for fiscal year 1991.

The model's predictions for October and November are very close to DESC's actual total monthly requisitions. However, during the following four months the predictions are not as close. The difference is attributed to the increased level of DoD activity as a result of Desert Shield and Desert Storm. The figures demonstrate that the "Winter's Model" monthly forecasts closely follows the attributes of the historical data with the exception of the increase in activity attributed to Desert Shield and Desert Storm. Therefore, 2,805,737 appears to be an accurate forecast for DESC's fiscal year 1991 total requisitions.

By utilizing the forecasted requisitions of 2,805,737 and the forecasted operating expenses provided by DLA headquarters of \$185.0 million, the operating costs can be allocated as a function of output or requisitions. Dividing the operational costs by total annual requisitions gives a cost per requisition of \$65.89.

$$\frac{\$185.0 \text{ MILLION (anticipated costs)}}{2,807,737 \text{ (forecasted requisitions)}} = \$65.89 \text{ (cost per acquisition) .}$$

DESC FY 86-90 REQUISITION HISTORY AND FY 91 FORECAST



DESC FY 91 ACTUAL MONTHLY REQUISITIONS PLOTTED WITH FORECASTED REQUISITIONS

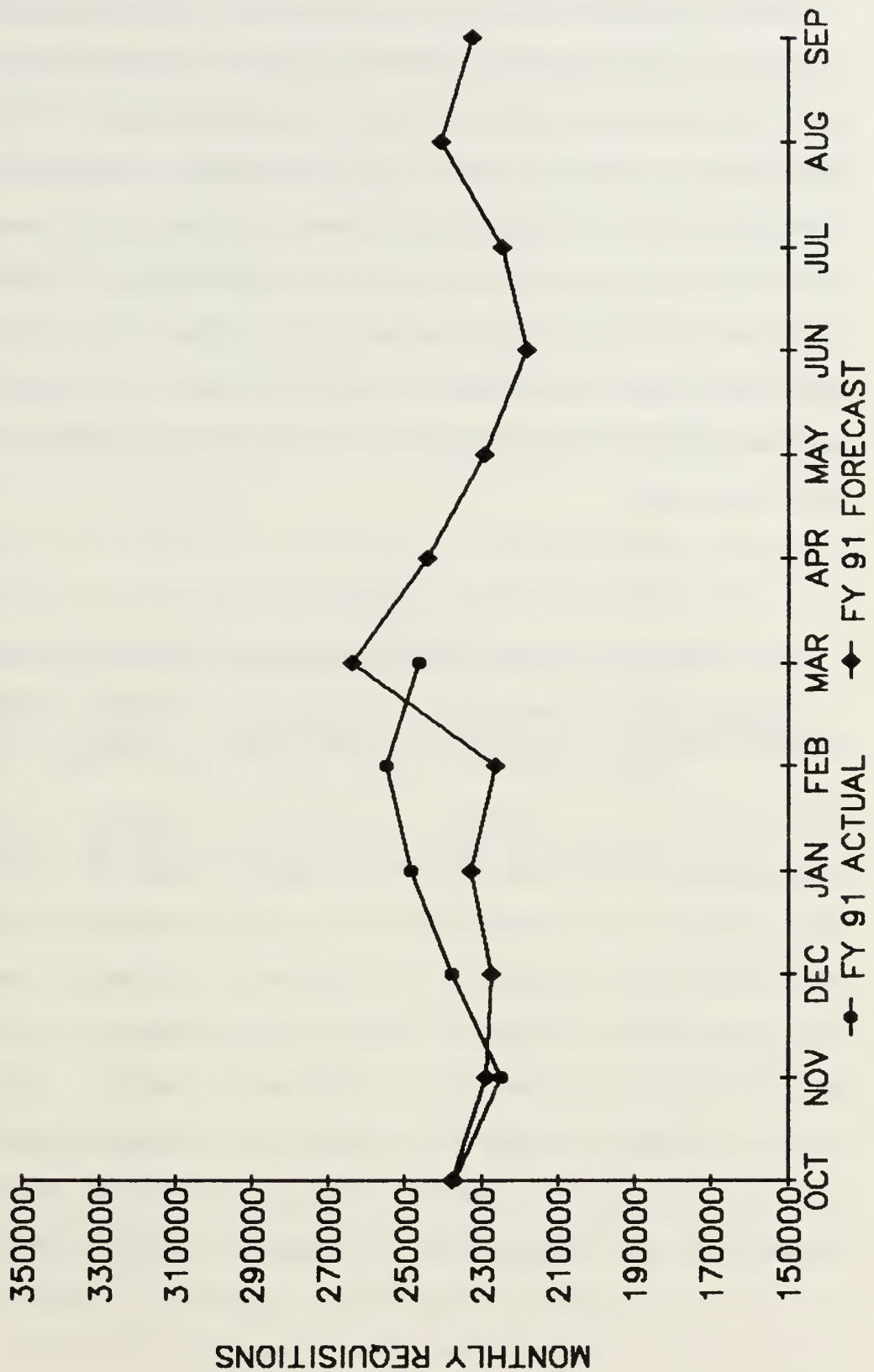


Figure 7. DESC's FY 91 Actual Requisitions with Forecasted Requisitions

The same price stratification used in the DESC model will be used to demonstrate the effect on the retail price of a line item by changing the allocation base. Table 5 provides the total retail price obtained by summing the median cost price, the 13.6 percent inventory maintenance surcharge and the \$65.89 cost per requisition. The table assumes that requisition size is only one unit. If more than one unit of an item is requisitioned the requisition cost would be spread equally over the total quantity requisitioned.

TABLE 5

UNITS OF OUTPUT MODEL: EFFECT ON RETAIL PRICES

<u>PRICE STRATIFICATION</u>	<u>MEDIAN PRICE</u>	<u>13.6 % SURCHARGE</u>	<u>COST/ REQ.</u>	<u>RETAIL PRICE</u>
\$0.01-1.00	\$0.50	\$0.07	\$65.89	\$66.46
\$1.01-5.00	\$3.00	\$0.41	\$65.89	\$69.30
\$5.01-10.00	\$7.50	\$1.02	\$65.89	\$74.41
\$10.01-25.00	\$17.50	\$2.38	\$65.89	\$85.77
\$25.01-50.00	\$37.50	\$5.10	\$65.89	\$108.49
\$50.01-100.00	\$75.00	\$10.20	\$65.89	\$151.09
\$100.01-500.00	\$300.00	\$40.80	\$65.89	\$406.69
\$500.01-1000.00	\$750.00	\$102.00	\$65.89	\$917.89
\$1000.00 & UP	\$3000.00	\$408.00	\$65.89	\$3473.89

The cost allocation model when a requisition processed is the unit of output has a dramatic effect on the retail price of line items when compared to using the unit cost of material as the allocation model. The two ends of the price stratification illustrate this point clearly. The retail price of a line item with a cost price of \$0.50 has increased from the DESC model sales price of \$0.75 to the units of output model sales price of \$66.46 while the price of a line item with a cost of \$3,000.00 has decreased from \$4,326.00 to \$3,473.89.

Allocating costs as a function of requisitions clearly demonstrates the disadvantage to customers who buy low quantity, low dollar line items. However, it is advantageous to customers who buy large quantity, low dollar line items and large dollar line items at any quantity.

D. VARIABLE SURCHARGE MODEL: ALLOCATING COSTS AS A
FUNCTION OF TOTAL REQUISITIONS PER DOLLAR VALUE RANGE

An additional method to allocate operational costs using requisitions as the base is to allocate the costs in relation to the frequency of requisitions in each dollar value range. This alternative aligns the proportion of total operational costs to the proportion of total requisitions in a specific dollar value range.

In order to allocate costs by this method the frequency of requisitions per dollar value range is required. DESC's monthly fractionation report provides this data. The report

identifies the total percentage of requisitions (at initial price) that fall into specific price ranges for the most recent 12-month period. It is presented in Table 6 in the middle under the column titled "percent of requisitions" [Ref. 22:pp. 1, 332]. The percent of requisitions for each dollar range is multiplied by the fiscal year 1991 forecasted operational costs (\$185.0 million), to get the total amount of operational costs per dollar value range price range shown in the last column of Table 6.

TABLE 6
OPERATIONAL COSTS PER PRICE RANGE BASED ON REQUISITION
FREQUENCY

<u>PRICE STRATIFICATION</u>	<u>PERCENT OF REQUISITIONS</u>	<u>OPERATIONAL COST PER RANGE</u>
\$.01-1.00	13%	\$24,050,000
\$1.01-5.00	20%	\$37,000,000
\$5.01-10.00	11%	\$20,350,000
\$10.01-25.00	14%	\$25,900,000
\$25.01-50.00	12%	\$22,200,000
\$50.01-100.00	10%	\$18,500,000
\$100.01-500.00	15%	\$27,750,000
\$500.01-1000.00	3%	\$5,550,000
\$1000.01 & UP	2%	\$3,700,000

The next step is to estimate the cost of sales per dollar value range. This is determined by utilizing DESC's

monthly fractionation report for annual sales volume per dollar value range. The report identifies the total percentage of sales (at retail price) that fall into a specific price range for the preceding 12-month period. This data is presented in Table 7 under the column heading "percent of total sales" [Ref. 22:pp. 1, 316]. The percent of sales is then multiplied by the fiscal year 1991 forecasted cost of sales (\$524,000,000) to compute a total cost of sales per dollar value range which is given in the last column of Table 7.

TABLE 7
COST OF SALES PER LINE ITEM PRICE RANGE

<u>PRICE STRATIFICATION</u>	<u>PERCENT OF TOTAL SALES</u>	<u>PROPORTION OF COST OF SALES</u>
\$.01-1.00	1%	\$5,240,000
\$1.01-5.00	4%	\$20,960,000
\$5.01-10.00	4%	\$20,960,000
\$10.01-25.00	9%	\$47,160,000
\$25.01-50.00	8%	\$41,920,000
\$50.01-100.00	12%	\$62,880,000
\$100.01-500.00	34%	\$178,160,000
\$500.01-1000.00	12%	\$62,880,000
\$1000.00 & UP	16%	\$83,840,000

The third step is to compute the variable surcharge percentage applicable to each dollar value range by dividing the forecasted operational costs from Table 6 by the proportion of cost of sales for each dollar value range from Table 7. The results are given in Table 8.

TABLE 8

VARIABLE SURCHARGE COMPUTATION PER LINE ITEM PRICE RANGE

<u>PRICE STRATIFICATION</u>	<u>OPERATIONAL COSTS</u>	<u>COST OF SALES</u>	<u>OP-COSTS/COST OF SALES=SURCHARGE</u>
\$0.01-1.00	\$24,050,000	\$5,240,000	459%
\$1.01-5.00	\$37,000,000	\$20,960,000	177%
\$5.01-10.00	\$20,350,000	\$20,960,000	97%
\$10.01-25.00	\$25,900,000	\$47,160,000	55%
\$25.01-50.00	\$22,200,000	\$41,920,000	53%
\$50.01-100.00	\$18,500,000	\$62,880,000	29%
\$100.01-500.00	\$27,750,000	\$178,160,000	16%
\$500.01-1000.00	\$5,550,000	\$62,880,000	9%
\$1000.01 & UP	\$3,700,000	\$83,840,000	4%

Finally Table 9 illustrates the effect the variable surcharge from Table 8 has on the retail price of individual line items per price range. The total price is computed by summing the median cost price, the 13.6 percent inventory maintenance surcharge and the variable surcharge computed in Table 8.

TABLE 9

VARIABLE SURCHARGE MODEL: EFFECT ON SALE PRICES

<u>PRICE STRATIFICATION</u>	<u>MEDIAN PRICE</u>	<u>13.6% SURCHARGE</u>	<u>VARIABLE SURCHARGE</u>	<u>RETAIL PRICE</u>
\$0.01-1.00	\$0.50	\$0.07	\$2.30 (459%)	\$2.87
\$1.01-5.00	\$3.00	\$0.41	\$5.31 (177%)	\$8.72
\$5.01-10.00	\$7.50	\$1.02	\$7.28 (97%)	\$15.80
\$10.01-25.00	\$17.50	\$2.38	\$9.63 (55%)	\$29.51
\$25.01-50.00	\$37.50	\$5.10	\$19.88 (53%)	\$62.48
\$50.01-100.00	\$75.00	\$10.20	\$21.75 (29%)	\$106.95
\$100.01-500.00	\$300.00	\$40.80	\$48.00 (16%)	\$388.80
\$500.01-1000.00	\$750.00	\$102.00	\$67.50 (9%)	\$919.50
\$1000.01 & UP	\$3000.00	\$408.00	\$120.00 (4%)	\$3528.00

Table 9 shows that the retail price per line item has significantly changed in comparison to Table 3 and Table 5. With this variable surcharge model the amount of funds recouped per line item price range is directly proportional to the requisition frequency of that price range. The lower valued line items incur a substantial surcharge. However, the total cost is not as exorbitant as the units of output model results shown in Table 5. For example, the \$0.50 median retail price increases to \$2.86 with the variable surcharge model and the price remains constant regardless of requisition quantity. The units of output model has a retail price of \$66.51, but the unit price decreases as the

quantity requisitioned per order increased. At the other end of the price range (a line item with a cost price of \$3000.00), the retail prices of the variable surcharge model and the units of output model are quite close (\$3528.00 and \$3473.94). The DESC model sales price of \$4326.00 is much higher.

E. IMPLEMENTING A FIXED ORDER CHARGE

Throughout private industry there are many companies whose business is comparable to DoD's logistical mission of providing material to customers. These companies contract, purchase, receive, warehouse, and ship material to customers. A closer parallel can be drawn between DoD inventory control points and companies that sell a wide range of varying products to the general public, such as Sears, and L.L. Bean. These companies process millions of customer orders annually and generally stock the material at company-owned facilities. However, one difference between private industry and DoD is private industries also pass along a portion of their operating expenses to the customer through a fixed order charge. The fixed order charge is normally called a shipping and handling charge.

The shipping and handling charges vary from company to company as Appendix C illustrates. Some charges are based on the actual shipping expenses while others are not. In the later category are companies which charge a flat fee;

such as L.L. Bean's \$3.50 charge or Microsoft's \$7.87 charge. For the rest, differentiation between shipping and handling varies. For example, Spiegel has a \$1.95 handling charge and then adds the actual shipping expenses. Others have the handling charge basically hidden in the total charge. For example, Sears charges a minimum shipping and handling charge of \$2.85 even if the item weighs less than one ounce and is shipped via mail.

The pervasive factor throughout the survey is that companies are recouping a portion of their operating expenses from their customers by utilizing a fixed order charge. The actual amount of that charge varies but there are some similarities.

The first similarity is a minimum charge. No company in the survey ships for free (even L.L. Bean after 70 years has implemented a charge of \$3.50 on all orders regardless of order price) and there is not an extraordinarily wide variance in the charges. The exception is for very large bulky or heavy items that cannot be shipped via U.P.S. or Federal Express. The charges for these shipments can vary greatly.

Thus, if DESC was to implement a fixed order charge, based on what seems economically feasible in the private sector, the author suggests a charge between \$5.00 and \$10.00 per requisition in addition to some computed surcharge. By implementing a fixed order charge, the amount of

operational costs to be recouped with the operational surcharge will decrease and the effect will be to reduce the unit retail price.

The effect a fixed order charge per requisition has on the retail prices of line items will be examined in the following subsections. The DESC model and the variable surcharge model's retail prices will be recomputed with \$5.00 and \$10.00 fixed order charges. The units of output model will not be included since it is already a fixed order charge model having a charge of \$65.94 per requisition.

1. DESC Model: Computing Line Item Retail Prices with A \$5.00 Fixed Order Charge

To determine the change in sales price if a \$5.00 fixed order charge is implemented, it is first necessary to determine the revenue such a charge would generate. The forecasted fiscal year 1991 requisitions of 2,805,737 multiplied by \$5.00 amounts to a revenue of \$14,028,685.00 for the year. This amount subtracted from the forecasted amount of operating costs of \$185.0 million results in \$170,971,315 which is the remaining operational costs that require recoupment by the surcharge. The \$170,971,315 divided by the \$524.0 million fiscal year 1991 forecasted cost of sales provides a new surcharge of 32.6 percent. The steps to determine the new surcharge are performed below:

STEP 1. REVENUE GENERATED BY THE FIXED ORDER CHARGE

$$2,805,737 \times \$5.00 = \$14,028,685$$

STEP 2. COSTS REMAINING TO BE RECOUPED WITH SURCHARGE

\$185.0 MILLION - \$14,028,685 = \$170,971,315

STEP 3. NEW SURCHARGE COMPUTATION

\$170,971,315/\$524.0 MILLION = 32.6 PERCENT SURCHARGE

Table 10 shows the \$5.00 fixed order charge's effect on the retail prices in the various line item price ranges. The table computes the retail price by summing the median cost price, the 13.6 percent inventory maintenance surcharge, the operational cost surcharge of 32.6 percent and the \$5.00 fixed order charge.

TABLE 10

DESC MODEL: RETAIL PRICE COMPUTATION WITH A \$5.00
FIXED ORDER CHARGE

<u>PRICE STRATIFICATION</u>	<u>MEDIAN PRICE</u>	<u>13.6% SURCH.</u>	<u>32.6% SURCH.</u>	<u>FIXED CHRG.</u>	<u>RETAIL PRICE</u>
\$0.01-1.00	\$0.50	\$0.07	\$0.16	\$5.00	\$5.73
\$1.01-5.00	3.00	0.41	0.98	5.00	\$9.39
\$5.01-10.00	7.50	1.02	2.45	5.00	\$15.97
\$10.01-25.00	17.50	2.38	5.71	5.00	\$30.59
\$25.01-50.00	37.50	5.10	12.23	5.00	\$59.83
\$50.01-100.00	75.00	10.20	24.45	5.00	\$114.65
\$100.01-500.00	300.00	40.80	97.80	5.00	\$443.60
\$500.01-1000.00	750.00	102.00	244.50	5.00	\$1101.50
\$1000.00 & UP	3000.00	408.00	978.00	5.00	\$4391.00

With the exception of the low value line items the changes in retail prices are very small when compared to retail prices shown in Table 3 (the DESC model retail prices without a fixed order charge). The surcharge is not reduced significantly enough by the \$5.00 fixed order charge to have a substantial effect on the retail prices.

2. DESC Model: Computing Line Retail Prices with a \$10.00 Fixed Order Charge

The DESC model retail prices will now be computed with a \$10.00 dollar fixed order charge. The process is identical to the method presented above. The only change is that the increased revenue the \$10.00 fixed order charge will generate will decrease the amount of funds the surcharge will be required to recoup, even more than the \$5.00 charge. The steps to compute the new surcharge percentage are performed below:

STEP 1. REVENUE GENERATED BY THE FIXED ORDER CHARGE

$$2,805,737 \times \$10.00 = \$28,057,370$$

STEP 2. COSTS REMAINING TO BE RECOUPED WITH SURCHARGE

$$\$185.0 \text{ MILLION} - \$28,057,370 = \$156,942,630$$

STEP 3. NEW SURCHARGE COMPUTATION

$$\$156,942,630 / \$524.0 \text{ MILLION} = 29.95 \text{ PERCENT SURCHARGE}$$

Table 11 illustrates the \$10.00 fixed order charge's effect on line item retail prices. The total price is computed by summing the median price, the 13.6 percent inventory maintenance surcharge, the 29.95 percent

operational cost surcharge and the \$10.00 fixed order charge.

TABLE 11

DESC MODEL: RETAIL PRICE COMPUTATION WITH A \$10.00
FIXED ORDER CHARGE

<u>PRICE STRATIFICATION</u>	<u>MEDIAN PRICE</u>	<u>13.6% SURCH.</u>	<u>29.95% SURCH.</u>	<u>FIXED CHRG.</u>	<u>RETAIL PRICE</u>
\$0.01-1.00	\$0.50	\$0.07	\$0.15	\$10.00	\$10.72
\$1.01-5.00	3.00	0.41	0.90	10.00	\$14.31
\$5.01-10.00	7.50	1.02	2.25	10.00	\$20.77
\$10.01-25.00	17.50	2.38	5.24	10.00	\$35.12
\$25.01-50.00	37.50	5.10	11.23	10.00	\$63.83
\$50.01-100.00	75.00	10.20	22.46	10.00	\$117.66
\$100.01-500.00	300.00	40.80	89.85	10.00	\$440.65
\$500.01-1000.00	750.00	102.00	224.63	10.00	\$1086.63
\$1000.00 & UP	3000.00	408.00	898.50	10.00	\$4316.50

Implementing either a \$5.00 or \$10.00 fixed order charge with the DESC model has little effect on the line item retail prices. The exception is in the low dollar value range where the large price increase items is almost totally attributable to the fixed order charge. The revenue generated by either the \$5.00 or \$10.00 fixed order charge is not substantial enough to reduce the DESC surcharge.

3. Variable Surcharge Model: Computing Retail Prices with a \$5.00 Fixed Order Charge

As above, to compute line item retail prices with a variable surcharge rate, the revenue that will be generated by the fixed order charge must first be determined. The same frequency of requisitions per line item price range utilized in Table 6 is used again in Table 12 to compute revenue generated from the fixed order charge.

The percent of requisitions per line item price range is multiplied by the forecasted fiscal year 1991 total requisitions (2,805,737) to determine the total number of requisitions per line item price range. The requisitions per line item price range is multiplied by the \$5.00 shipping and handling charge to determine the revenue generated per line item price range. The percent of operating costs per line item price range is computed by multiplying the percent of requisitions per line item price range by the total operating costs (185.0 million). Subtracting the revenue generated (from the shipping and handling charge per line item price range) from the operating costs per line item price range gives the remaining operating costs to be recouped per line item price range. Table 12 illustrates the computations for determining the operating costs requiring recoupment per line item price range.

TABLE 12

COMPUTING OPERATIONAL COSTS REQUIRING RECOUPMENT WITH A
\$5.00 FIXED ORDER CHARGE

- COLUMN 1. PRICE STRATIFICATION
- COLUMN 2. PERCENT OF REQUISITIONS PER LINE ITEM DOLLAR RANGE
- COLUMN 3. TOTAL REQUISITIONS PER LINE ITEM DOLLAR RANGE
(2,807,737 X COLUMN 2)
- COLUMN 4. FUNDS RECOUPED VIA \$5.00 FIXED ORDER CHARGE
(\$5.00 X COLUMN 3)
- COLUMN 5. TOTAL OPERATING COSTS PER LINE ITEM DOLLAR RANGE
(185.0 MILLION X COLUMN 2)
- COLUMN 6. OPERATING COSTS REQUIRING RECOUPMENT PER LINE
ITEM DOLLAR RANGE (COLUMN 5 MINUS COLUMN 4)

(Columns 1, 4, 5 and 6 in Dollars)

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6
\$0.01-1.00	13%	365,006	1,825,030	24,050,000	22,224,970
\$1.01-5.00	20%	561,547	2,807,735	37,000,000	34,192,265
\$5.01-10.00	11%	308,851	1,544,255	20,350,000	18,805,745
\$10.01-25.00	14%	393,083	1,965,415	25,900,000	23,934,585
\$25.01-50.00	12%	336,928	1,684,640	22,200,000	20,515,360
\$50.01-100.00	10%	280,773	1,403,865	18,500,000	17,096,135
\$100.01-500.00	15%	421,161	2,105,805	27,750,000	25,644,195
\$500.01-1000.00	3%	84,232	421,160	5,550,000	5,128,840
\$1000.01 & UP	2%	56,154	280,470	3,700,000	3,419,230

The next step is to determine the variable surcharge per line item price range. To compute this, the percent of

sales per line item price range is multiplied by the fiscal year 1991 forecasted amount of cost of sales (524.0 million) resulting in the cost of sales per line item price range. The operational costs per line item price range (Column 6, Table 12) is divided by the cost of sales line item price range to determine the variable surcharge per line item price range. Table 13 summarizes the computations to determine the variable surcharge per line item price range.

TABLE 13

VARIABLE SURCHARGE PER LINE ITEM PRICE RANGE WITH A \$5.00
FIXED ORDER CHARGE

<u>PRICE STRATIFICATION</u>	<u>PERCENT OF TOTAL SALES</u>	<u>PROPORTION OF COST OF SALES</u>	<u>OP.COSTS/COST OF SALES= SURCHARGE</u>
\$0.01-1.00	1%	\$5,240,000	424%
\$1.01-5.00	4%	\$20,960,000	163%
\$5.01-10.00	4%	\$20,960,000	90%
\$10.01-25.00	9%	\$47,160,000	51%
\$25.01-50.00	8%	\$41,920,000	49%
\$50.01-100.00	12%	\$62,880,000	27%
\$100.01-500.00	34%	\$178,160,000	14%
\$500.01-1000.0	12%	\$62,880,000	8%
\$1000.00 & UP	16%	\$83,840,000	4%

Table 14 presents the resulting retail price per line item price range. The price is computed by summing the

median cost price, the inventory maintenance surcharge, the variable surcharge and the \$5.00 fixed order charge.

TABLE 14

VARIABLE SURCHARGE MODEL: SALE PRICES WITH A \$5.00
FIXED ORDER CHARGE

<u>PRICE STRATIFICATION</u>	<u>MEDIAN PRICE</u>	<u>13.6% SURCH.</u>	<u>VARIABLE SURCHARGE</u>	<u>FIXED CHRG.</u>	<u>RETAIL PRICE</u>
\$0.01-1.00	\$0.50	\$0.07	\$2.12 (424%)	\$5.00	\$7.69
\$1.01-5.00	\$3.00	\$0.41	\$4.89 (163%)	\$5.00	\$13.30
\$5.01-10.00	\$7.50	\$1.02	\$6.75 (90%)	\$5.00	\$20.27
\$10.01-25.00	\$17.50	\$2.38	\$8.93 (51%)	\$5.00	\$33.81
\$25.01-50.00	\$37.50	\$5.10	\$18.38 (49%)	\$5.00	\$65.98
\$50.01-100.00	\$75.00	\$10.20	\$20.25 (27%)	\$5.00	\$110.45
\$100.01-500.00	\$300.00	\$40.80	\$42.00 (14%)	\$5.00	\$387.80
\$500.01-1000.00	\$750.00	\$102.00	\$60.00 (8%)	\$5.00	\$917.00
\$1000.01 & UP	\$3000.00	\$408.00	\$120.00 (4%)	\$5.00	\$3533.00

The change between the retail prices in Table 9 (the variable surcharge model without fixed order charges) and those in Table 14 (the variable surcharge rate with a \$5.00 fixed order charge) is moderate. The majority of the price change is attributable to the fixed order charge. Again, as with the DESC model, the revenue generated by the \$5.00 fixed order charge is not sufficient to substantially reduce the variable surcharge.

4. Variable Surcharge Model: Computing Retail Prices with a \$10.00 Fixed Order Charge

To compute the retail price per line item range with a \$10.00 fixed order charge the same procedure will be followed as for the computations with a \$5.00 fixed order charge. Table 15 illustrates the first step in the process, computing the operating costs requiring recoupment per line item price range.

The second step is to compute the variable surcharge for each line item range. Again, the process for computing the variable surcharge with a \$10.00 fixed order charge is the same as the computation with a \$5.00 fixed order charge. The cost of operations per line item dollar range (Column 6, Table 15) is divided by the proportion of cost of sales per line item dollar range. The computations for determining the variable surcharge with a \$10.00 fixed order charge are summarized in Table 16.

TABLE 15

COMPUTING OPERATIONAL COSTS REQUIRING RECOUPMENT WITH A
\$10.00 FIXED ORDER CHARGE

COLUMN 1. PRICE STRATIFICATION

COLUMN 2. PERCENT OF REQUISITIONS PER LINE ITEM DOLLAR RANGE

COLUMN 3. TOTAL REQUISITIONS PER LINE ITEM DOLLAR RANGE
(2,807,737 X COLUMN 2)

COLUMN 4. FUNDS RECOUPED VIA \$5.00 FIXED ORDER CHARGE
(\$10.00 X COLUMN 3)

COLUMN 5. TOTAL OPERATING COSTS PER LINE ITEM DOLLAR RANGE
(185.0 MILLION X COLUMN 2)

COLUMN 6. OPERATING COSTS REQUIRING RECOUPMENT PER LINE
ITEM DOLLAR RANGE (COLUMN 5 MINUS COLUMN 4)

(Columns 1, 4, 5 and 6 in Dollars)

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6
\$0.01-1.00	13%	365,006	3,650,060	24,050,000	20,399,940
\$1.01-5.00	20%	561,547	5,615,470	37,000,000	31,384,530
\$5.01-10.00	11%	308,851	3,088,510	20,350,000	17,261,490
\$10.01-25.00	14%	393,083	3,930,830	25,900,000	21,969,170
\$25.01-50.00	12%	336,928	3,369,280	22,200,000	18,830,720
\$50.01-100.00	10%	280,773	2,807,730	18,500,000	15,692,270
\$100.01-500.00	15%	421,161	4,211,610	27,750,000	23,538,390
\$500.01-1000.00	3%	84,232	842,320	5,550,000	4,707,680
\$1000.01 & UP	2%	56,154	561,540	3,700,000	3,138,460

TABLE 16

VARIABLE SURCHARGE PER LINE ITEM PRICE RANGE WITH A \$5.00
FIXED ORDER CHARGE

<u>PRICE STRATIFICATION</u>	<u>PERCENT OF TOTAL SALES</u>	<u>PROPORTION OF COST OF SALES</u>	<u>OP.COSTS/COST OF SALES=SURCHARGE</u>
\$0.01-1.00	1%	\$5,240,000	389%
\$1.01-5.00	4%	\$20,960,000	150%
\$5.01-10.00	4%	\$20,960,000	82%
\$10.01-25.00	9%	\$47,160,000	47%
\$25.01-50.00	8%	\$41,920,000	45%
\$50.01-100.00	12%	\$62,880,000	25%
\$100.01-500.00	34%	\$178,160,000	13%
\$500.01-1000.0	12%	\$62,880,000	7%
\$1000.00 & UP	16%	\$83,840,000	4%

Table 17 presents the sale prices for the various line item price ranges when there is a \$10.00 fixed order charge. The price is computed by summing the median cost price, the inventory maintenance surcharge, the variable surcharge and the \$10.00 fixed order charge.

The change in retail prices with a \$10.00 fixed order charge is insignificant in comparison with the variable surcharge model without a fixed order charge and the variable surcharge model with a \$5.00 fixed order charge. The only substantial retail price differences are with the low value line items and this change, as expected is largely due to the fixed order charge.

TABLE 17

VARIABLE SURCHARGE MODEL: RETAIL PRICES WITH A \$10.00
FIXED ORDER CHARGE

<u>PRICE STRATIFICATION</u>	<u>MEDIAN PRICE</u>	<u>13.6% SURCH.</u>	<u>VARIABLE SURCHARGE</u>	<u>FIXED CHRG.</u>	<u>RETAIL PRICE</u>
\$0.01-1.00	\$0.50	\$0.07	\$1.95(389%)	\$10.00	\$12.52
\$1.01-5.00	3.00	0.41	4.50(150%)	10.00	\$17.91
\$5.01-10.00	7.50	1.02	6.15(82%)	10.00	\$24.67
\$10.01-25.00	17.50	2.38	8.23(47%)	10.00	\$38.11
\$25.01-50.00	37.50	5.10	16.88(45%)	10.00	\$69.48
\$50.01-100.00	75.00	10.20	18.75(25%)	10.00	\$113.95
\$100.01-500.00	300.00	40.80	39.00(13%)	10.00	\$389.80
\$500.01-1000.00	750.00	102.00	52.50(7%)	10.00	\$914.50
\$1000.01 & UP	3000.00	408.00	120.00(4%)	10.00	\$3538.00

F. SUMMARY

Three basic models for determining retail prices were presented in this chapter; the DESC model, the "units of output model" and the variable surcharge model. The models were used to compute unit retail prices for fiscal year 1991. Two of these models, the DESC model and the variable surcharge model, were then modified to allow a \$5.00 or \$10.00 fixed order charge.

Each model has the potential to recoup all DESC's fiscal year operating costs. Depending on which model is used, the price a customer pays for one unit of a line item varies significantly. Table 18 summarizes the prices generated by

the various models and illustrates the wide variance of line item retail prices which resulted. For example, Table 18 shows that for a line item with a cost price of \$0.50 the retail price for one unit would \$0.75 using the DESC model without any fixed order charge, \$5.73 using the DESC model and a \$5.00 fixed order charge and \$10.71 using the DESC model and a \$10.00 fixed order charge, \$66.51 using the units of output model, \$2.86 using the variable surcharge model, \$7.69 using the variable surcharge with a \$5.00 fixed order charge, and \$12.52 using the variable surcharge model with a \$10.00 fixed order charge.

TABLE 18

RETAIL PRICE COMPARISON BETWEEN MODELS

COLUMN 1: MEDIAN PRICE PER LINE ITEM DOLLAR RANGE

COLUMN 2: DESC MODEL: W/O ORDER CHARGE

COLUMN 3: DESC MODEL: WITH \$5.00 ORDER CHARGE

COLUMN 4: DESC MODEL: WITH \$10.00 ORDER CHARGE

COLUMN 5: UNITS OF OUTPUT MODEL

COLUMN 6: VARIABLE SURCHARGE MODEL: W/O ORDER CHARGE

COLUMN 7: VARIABLE SURCHARGE MODEL: WITH \$5.00 ORDER CHARGE

COLUMN 8: VARIABLE SURCHARGE MODEL: WITH \$10.00 ORDER CHARGE

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4	COLUMN 5	COLUMN 6	COLUMN 7	COLUMN 8
\$0.50	\$0.75	\$5.73	\$10.72	\$66.46	\$2.87	\$7.69	\$12.52
3.00	4.47	9.39	14.31	69.30	8.72	13.30	17.91
7.50	11.17	15.97	20.77	74.41	15.80	20.27	24.67
17.50	26.06	30.59	35.12	85.77	29.51	33.81	38.11
37.50	55.84	59.83	63.83	108.49	62.48	65.98	69.48
75.00	111.68	114.65	117.66	151.09	106.95	110.45	113.95
300.00	446.70	443.60	440.65	405.69	388.80	387.80	389.80
750.00	1116.75	1101.50	1086.63	917.89	919.50	917.00	914.50
3000.00	4467.00	4391.00	4316.50	3473.89	3528.00	3533.00	3538.00

IV. DISCUSSION

This chapter discusses the advantages and disadvantages of each of the models presented in Chapter III. It also addresses some of the problems associated with implementing a fixed order charge.

A. THE DESC MODEL

The disadvantage of using the DESC model is that the amount of funds recouped per requisition does not correlate with the costs incurred. In order to justify this statement it is necessary to review the operational costs required to be recouped. The total costs requiring recoupment by DESC for fiscal year 1991 are \$185.0 million (DESC operations: \$84.1 million, Depot costs: \$86.5 million, Real Property Maintenance Reserve: \$2.0 million, Defense Systems Automation Center (DSAC): \$2.0 million, Defense Logistics Service Center (DLSC): \$5.0 million, Military Personnel: \$2.0 million and Management Support Activities: \$3.4 million).

These operational costs are not incurred as a function of the cost of material but rather as a function of the number of line items carried and requisitions processed. Based on these factors DLA headquarters determined DESC's depot costs for fiscal year 1991 at \$185.0 million. [Ref. 2]

The costs for the DSAC, DLSC and Management Support Activities are allocated to DESC as a function of the total number of DLA line items DESC manages. DESC manages approximately 35 percent of all DLA line items. Thus, DLA headquarters allocates 35 percent of the cost of these activities to DESC [Ref. 2].

By examining the actual funds the DESC model's operational surcharge recoups in the lowest price range (\$0.01-1.00) and the highest price range (\$1,000.00 and up), it is clearly evident there is no correlation between operational costs allocated to DESC by DLA headquarters and the funds recouped. Table 6 shows the \$0.01-1.00 price range encompasses 13 percent of DESC's total annual requisitions. Thirteen percent of the total annual operational cost of \$185.0 million is \$24,050,000. However, as Table 7 illustrates, the 13 percent of total requisitions in the \$0.01-1.00 price range only represents one percent of total sales or one percent of the cost of sales ($\$524,000,000 \times 1\% = \$5,240,000$). When using the DESC model to allocate costs as a function of the cost of direct material, this cost of sales figure should be multiplied by operational surcharge rate of 35.3 percent. Unfortunately, the one percent cost of sales recoups only \$1,849,720 ($\$5,240,000 \times 35.3\% = \$1,849,720$). The DESC model creates a large disparity between the operational funds recouped of \$1,849,720 and the proportional operational costs of \$24,050,000 (incurred by

13 percent of DESC's total annual requisitions) which need to be recouped.

This disparity is also evident in the highest price range; \$1,000.00 and up. The total number of requisitions in that price range, as shown in Table 6, is two percent of DESC's total fiscal year 1991 requisitions. The proportional cost of this two percent is \$3,700,000 ($2\% \times 185.0 \text{ million} = \$3,700,000$). However, Table 7 shows the cost of sales for the \$1,000.00 and up price range is \$83,840,000. The DESC model would recoup \$29,595,520 of operational costs ($\$83,840,000 \times 35.3\% = \$29,595,520.00$) which far exceeds that incurred for this price range.

The DESC model does not equitably distribute operational costs among its customer base; it is prejudiced towards customers purchasing high dollar value line items. The result of this disparity is dissatisfaction among customers who purchase high dollar value line items and may, when possible, seek alternative sources of supply for the material.

B. THE UNITS OF OUTPUT MODEL

The units of output model treats the allocation of operational costs more equitably than the DESC model. However, problems would be encountered with implementing the units of output model.

The \$65.89 charge per requisition far exceeds what is comparable with private industry. It would be difficult to justify to a customer requisitioning a single line item with a unit retail price of \$1.00 that an additional \$65.89 requisition or order charge must also be incurred.

The customer would also have problems insuring that the correct amount of funding was obligated on the requisition document because, if the requisition was passed to another activity having a different requisition charge, the customer could be burdened with retroactively correcting his accounting data. This is discussed further in a later section addressing fixed order charge models.

For customers purchasing large quantities of low dollar value line items and customers purchasing high dollar value line items the units of output model is preferable to the DESC model. The opposite is true for customers purchasing small quantities of low dollar value line items.

C. THE VARIABLE SURCHARGE MODEL

The variable surcharge model raises problems separate from the other models presented. It takes much more data to implement the variable surcharge model. It is critical to accurately forecast the expected number of annual requisitions, the expected cost of sales and the expected number of requisitions per price range. Without accurate data, the operational surcharge percentage per price range would not

be precise. This would cause the amount of operational costs recouped throughout the year to be insufficient or in excess of requirements.

The variable surcharge model also requires substantial surcharge percentages to be placed on the low dollar value range line items. For example, as Table 9 illustrates, the variable surcharge for the \$0.01-1.00 price range is 459 percent. The retail price for an individual line item with an initial price of \$0.50 increases from \$0.50 to \$2.86 as a consequence.

The total requisition cost for customers requisitioning a single unit of a low dollar value item does not appear prohibitive. However, customers requisitioning large quantities of low dollar value line items will incur a substantial operational surcharge cost in the total requisition. For example, a customer who orders a single unit with a retail price of \$2.86 contributes \$2.29 to cost of operations due to the operational surcharge. However, if the customer requisitions 1000 units, \$2290.00 is contributed to the cost of operations. This may appear to be out of line because the material cost to DESC is only \$500.00.

However, as the initial price increases, the variable surcharge model becomes more retail price advantageous to the customer. Table 18 illustrates that for line items with a median cost of \$12.50 or more, the sale price between the

DESC model and the variable surcharge are is much closer. When the median cost price exceeds \$75.00, the variable surcharge model's sale price is lower and becomes substantially lower as the initial price continues to increase.

D. FIXED ORDER CHARGE

The amount of revenue the \$5.00 or \$10.00 fixed order charge generates will not substantially lower the operational surcharge and therefore the unit retail price of an item. A \$5.00 fixed order charge recoups only 7.59 percent of the annual operational costs and a \$10.00 fixed order charge recoups only 15.18 percent.

1. Marginal Effect of a Fixed Order Charge on the DESC Model

Table 19 provides a comparison between unit retail prices of the DESC model with a fixed charge and the same model with a \$5.00 and \$10.00 fixed charge. The retail price change at the lowest median price of \$0.50 decreases only three percent with a \$5.00 charge and five percent with a \$10.00 charge. At the highest median price of \$3000, the retail price only decreases two percent with a \$5.00 charge and four percent with a \$10.00 charge.

TABLE 19

DESC MODEL: RETAIL PRICES WITH AND WITHOUT A \$5.00 AND
\$10.00 FIXED ORDER CHARGE

<u>MEDIAN COST</u>	<u>SALE PRICE W/O CHRG.</u>	<u>SALE PRICE WITH \$5.00 CHRG.</u>	<u>SALE PRICE WITH \$10.00 CHRG.</u>
\$0.50	\$0.75	\$0.73	\$0.72
3.00	4.47	4.39	4.31
7.50	11.17	10.97	10.77
17.50	26.06	25.59	25.12
37.50	55.84	54.83	53.83
75.00	111.68	109.65	107.66
300.00	446.70	438.60	430.65
750.00	1116.75	1096.50	1076.63
3000.00	4467.00	4386.00	4306.50

2. Marginal Effect of a Fixed Order Charge on the
Variable Surcharge Model

Table 20 provides a comparison between unit retail prices of the variable surcharge model without a fixed charge and the same model with a \$5.00 and \$10.00 fixed charge. Again, as illustrated above in Table 19, the change in unit retail prices at the lowest levels are insignificant.

With both the DESC model and the variable surcharge model, the fixed order charges considered had little effect on the retail price. In order for the fixed order charge to significantly reduce the surcharge percentage, and hence the

TABLE 20

VARIABLE SURCHARGE MODEL: RETAIL PRICES WITH AND WITHOUT
A \$5.00 AND \$10.00 FIXED ORDER CHARGE

<u>MEDIAN COST</u>	<u>RETAIL PRICE W/O CHRG.</u>	<u>RETAIL PRICE WITH \$5.00 CHRG.</u>	<u>RETAIL PRICE WITH \$10.00 CHRG.</u>
\$0.50	\$2.87	\$2.69	\$2.52
3.00	8.72	8.30	7.91
7.50	15.80	15.27	14.67
17.50	29.51	28.81	28.11
37.50	62.48	60.98	59.48
75.00	106.95	105.45	103.95
300.00	388.80	382.80	379.80
750.00	919.50	912.00	904.50
3000.00	3528.00	3528.00	3528.00

retail price, it would have to exceed either the \$5.00 or \$10.00 fixed order charge considered so far.

3. Fixed Order Charges Relationship to the Size of the Surcharge

To provide some perspective on how large the fixed order charge would have to be to substantially reduce the operational surcharge, Table 21 shows the operational surcharge which results by varying the fixed order charge from \$5.00 to \$65.89. The \$65.89 charge is the same dollar value computed for the cost per requisition by the units of output model. The table computes the operational surcharge percentage using the DESC model. The table uses the

forecasted requisitions of 2,807,737, the forecasted operational costs of \$185.0 million and the forecasted cost of sales of \$524.0 million. The required surcharge is computed by multiplying the number of requisitions by the fixed order charge, subtracting the revenue generated by the fixed order charge from the operational costs and then dividing the remaining operational costs by the cost of sales.

TABLE 21

OPERATIONAL SURCHARGE REQUIRED AS A FUNCTION OF THE
FIXED ORDER CHARGE FOR THE DESC MODEL

<u>CHARGE</u>	<u>GENERATED</u>	<u>REMAINING</u>	<u>SURCHARGE</u>
\$5.00	\$14,038,685.00	\$170,961,315.00	33%
10.00	28,077,370.00	156,922,640.00	30%
15.00	42,116,055.00	142,883,945.00	27%
20.00	56,154,740.00	128,845,260.00	25%
25.00	70,193,425.00	114,806,575.00	22%
30.00	84,232,110.00	100,767,890.00	19%
35.00	98,270,795.00	86,729,205.00	17%
40.00	112,309,480.00	72,690,520.00	14%
45.00	126,348,165.00	58,651,835.00	11%
50.00	140,386,850.00	44,613,150.00	9%
55.00	154,425,535.00	30,574,465.00	6%
60.00	168,464,220.00	16,535,780.00	3%
65.89	185.0 MILLION	0	0%

As Table 21 illustrates, the higher the fixed order charge, the lower the operational surcharge will be. As Tables 10 and 11 demonstrated, the low cost items' retail prices are the most adversely affected by adding on a fixed order cost. The higher cost line items' retail prices are not significantly affected. Finally, as Tables 19 and 20 show, the higher the fixed order cost the lower the retail prices will be.

4. Different Fixed Order Charges

As mentioned in the discussion of the units of output model, if each individual inventory control point had different fixed order charges, a customer would be required to know these charges to ensure the obligated funds on a requisition document were correct. An additional problem arises if a requisition is passed between inventory control points. For example, if a customer obligates for the fixed charge for the inventory control point that the requisition is submitted to and the requisition is then passed to another inventory control point, where the charges differ from the first, the funds obligated by the customer would be incorrect. Subsequently, the customer would be required to retroactively adjust the obligated funds.

E. SUMMARY

The following is a summary of the major points of the chapter.

The DESC model creates a large disparity in the amount of operational funds recouped per requisition. Small dollar value line items recoup only an inconsequential amount of the operational costs whereas the large dollar value line items recoup the brunt of the operational costs. By applying the straight surcharge percentage on all line items identically, the low value line items have a small price increase whereas the large value line items incur a substantial price increase.

With the units of output model each requisition incurs a substantial fixed order charge of \$65.89. For customers ordering large dollar value line items, the fixed order cost only has a minimal effect on the retail price. However, for low dollar value line items, requisitioned in small quantities, the charge appears exorbitant.

The variable surcharge models require more data to implement than the other models. The low dollar value line items incur a substantial surcharge. However, in the medium and high dollar value price ranges, the retail prices are competitive with the units of output model and are lower than the DESC model.

In order for a fixed order charge to substantially reduce the operational costs to be recouped by the surcharge, the charge would have to exceed the \$5.00 or \$10.00 charge suggested from private industry. The \$5.00 or \$10.00 fixed order charge has little effect on the retail

price of line items whether computing the retail prices with the DESC model or the variable surcharge model. The fixed order charge also puts an additional burden on the customer; he must ensure the correct fixed order charge is included in the requisition document and if the requisition is passed to another activity, he may be required to correct his accounting data to reflect that activity's different fixed order charge.

V. SUMMARY, CONCLUSIONS AND A RECOMMENDATION

A. SUMMARY

DMRD 901 requires inventory control points managing DoD stock-funded material to include all the costs of doing business in the stock fund surcharge. The inventory control points will no longer receive direct operational and maintenance (O&M) funding in the defense budget.

For fiscal year 1991, DLA Headquarters did not receive over \$800 million of O&M funds. These O&M funds, previously earmarked for DLA activities, were apportioned to the various military services that requisition DLA material. As Chapter II discussed, DLA Headquarters is now required to recoup those funds with an operational surcharge added to the cost of material that customers requisition. [Ref. 2] As a consequence, each DLA inventory control point is now required to recoup all its own operational costs and, in addition, a portion of DLA Headquarter's costs and a portion of DLA support activities' costs. For fiscal year 1991, DESC must recoup, through its operational surcharge, \$84.1 million of its own operational costs and \$100.9 million of DLA Headquarters and support activity costs (a total of \$185.0 million). These additional costs required DESC to increase their surcharge from 13.6 percent to 44.2 percent for fiscal year 1991. The increased surcharge has

significantly raised the retail price DESC's customers must now pay for material requisitioned.

DESC presently recoups the operational costs by allocating costs as a function of the cost of direct material (this method is referred to by the author as the DESC model). By utilizing the DESC model, all line items incur the same surcharge or the same percentage of price increase. As a result, low dollar value line items have a relatively small increase in the retail price. However, as the direct cost of the material increases, the surcharge increases substantially. For example, for an item with a cost price of \$3000.00, the retail price is \$4467.00 because \$1467.00 of the price increase is attributed to the surcharge.

Generally accepted accounting principles provide a wide latitude for allocating costs, but costs are required to be allocated according to some common base. The most common bases for allocating costs are: direct material costs, direct labor costs, direct labor hours, machine hours and units of output. For DESC, only two of these allocation bases are applicable; direct material costs and units of output.

Chapter III recomputed retail prices by changing the allocation base used to recoup operational costs. Additional analysis was conducted to determine what effect a fixed order charge would on the unit retail prices when used in conjunction with the DESC model and the units of output

model. Chapter III first reviewed the DESC model. This is the method DESC used to compute the fiscal year 1991 surcharge. The DESC model's effect on line item retail prices was determined for various price categories ranging from \$0.50 to \$3000.00.

The first alternate model presented was the units of output model, in which operational costs were allocated as a function of total requisitions. This model resulted in a cost per requisition or order cost of \$65.94.

The second alternative, the variable surcharge model, allocated operational costs as a function of the frequency of requisitions per line item dollar value range. This model aligned the proportion of total operational costs in a dollar value range to the proportion of total requisitions in that dollar value range. This model resulted in a variable surcharge per line item dollar range. The variable surcharge ranged from 459 percent for low dollar value line items to four percent for high dollar value line items. The median retail price of line items in each category were then computed using the variable surcharge model.

The next models attempted to determine what effect a fixed order charge would have on the retail price of line items. A \$5.00 or \$10.00 fixed order charge was determined to be economically feasible because it is comparable with private industry. Both the DESC model and the variable surcharge model retail prices were recomputed with a \$5.00

and \$10.00 fixed order charge. The units of output model was not considered because it has a fixed order charge of \$65.89 which recoups all the additional costs allocated to DESC by DLA headquarters.

The results of Chapter III were seven separate pricing models. Table 18 illustrates all of the models' retail prices. The retail price of the line items differed significantly between the models.

Chapter IV discussed the advantages and disadvantages of each of the models presented in Chapter III and addressed some of the problems associated with implementing a fixed order charge.

B. CONCLUSIONS

The author's conclusions based on the analyses conducted in the thesis are summarized as follows.

1. DESC Model

For the DESC model (allocating costs as a function of the cost of material) the operational costs recouped per requisition do not correlate with the operational costs incurred to process the requisitions. The consequence is an extreme inequity in the amount of funds the straight 35.3 percent operational surcharge recoups per requisition. The two ends of the price range clearly exemplify this disparity. A single item requisitioned with a cost price of \$0.50 has a total surcharge increase of only \$0.25. In

comparison, a single item requisitioned with a cost price of \$3000 has a total surcharge increase of \$1467.00.

Low value line items (\$25.00 and under) account for only 18 percent of DESC's total annual sales and thus will recoup only 18 percent of the operational costs. However, these low value line items account for 58 percent of DESC's total annual requisitions. Large dollar requisitions (\$25.01 and up) account for 42 percent of DESC's total requisitions and, under the DESC model, recoup 72 percent of the operational costs. Therefore, the DESC model is advantageous to customers who requisition low dollar value items but is disadvantageous to customers who requisition large dollar value items.

2. Units of Output Model

The units of output model allocated costs as a function of DESC's total annual requisitions. All operational costs were recouped in a fixed order cost per requisition. The order cost per requisition was computed to be \$65.89. This cost per requisition would be added to all requisitions regardless of the quantity of units ordered or the total price of the requisition. The units of output model reversed the customer retail price advantages and disadvantages that were present with the DESC model. Assuming a requisition size of one unit, the low value line item's retail prices were not advantageous to customers

while high value line item's retail prices were advantageous.

3. Variable Surcharge Model

The variable surcharge model allocated costs as a function of the frequency of requisitions per line item dollar range. This resulted in an operational surcharge varying from 459 percent for low dollar value items to four percent for high dollar value items. The low dollar value item retail price was higher than the DESC model, but lower than the units of output model. However, if a customer ordered a large quantity of low dollar value items the total price increase attributed to the operational surcharge seems to be rather exorbitant. But, as the cost price increased, the retail prices became significantly lower than the DESC model. Only a moderate difference existed between the units of output model and the variable surcharge model.

4. Fixed Order Charges

When a \$5.00 or \$10.00 fixed order charge is included in either the DESC model or the variable surcharge model, the effect on sale prices was small. For example, computing the retail prices using the DESC model and the \$0.50 median price, the retail price decreased only three percent with a \$5.00 fixed order charge and five percent with a \$10.00 fixed order charge. At the highest median price of \$3000.00, the retail price only decreased two

percent with a \$5.00 charge and four percent with a \$10.00 charge.

The \$5.00 fixed order charge recouped only 7.59 percent of the cost total costs of operations and the \$10.00 fixed order charge recouped only 15.18 percent of the total costs of operations. If a fixed order charge was to be used by DESC to substantially reduce the operational surcharge, the charge would have to exceed what is commonplace in the private sector.

There would be additional problems at the customer level with a fixed order charge. The customer would have to ensure the correct fixed order charge was included in the obligation document for the activity the requisition was submitted to. Furthermore, if the requisition was passed between activities which had different charges, the customer would be obligated to retroactively correct his accounting data.

Problems would also be encountered if the fixed order charge was so large that it appears to be disproportionate to the retail price of the material. A customer is inclined to be dissatisfied if, for example, the retail price of the line item is only \$0.50 and the fixed order charge is \$25.00 for that requisition.

C. RECOMMENDATION

None of the models presented is a panacea for alleviating all customer dissatisfaction. It is not possible to allocate \$185.0 million of DESC's operational costs using any of the models without creating dissatisfaction to some customers. Therefore, the author recommends further analyses to develop a clear understanding of DESC's customer base. By doing so, insight may be provided about which model is appropriate. For example, if a large percentage of the requisitions is for single quantities, it might be advisable to implement a fixed order cost. Because of its size, the fixed order cost would provide customers with an economic incentive to increase their order quantities. This, in turn, would result in efficiencies and reduce costs at the inventory control points and depots.

However, it is also necessary to have a clear understanding of the nature of the customers to ascertain if it is possible for them to increase the requisition quantity. For example, many small operational units such as ships, air squadrons, and other mobile units have limited space for spare parts, making it impractical to order more economical quantities. Furthermore, the requisition of a small quantity could be required to fill a stock deficiency from the unit's allowance list and local regulations may prohibit ordering in excess of the allowance list. Under these

circumstances it might be more practical to implement a variable surcharge.

It is the author's belief that DESC's objective should be to implement a model that is least "painful" to the largest portion of their customers. That model has not been provided in this thesis. Some additional research, reflecting on the models provided here, should yield the desired results.

APPENDIX A

DESC TOTAL YEARLY REQUISITIONS FY 86-FY 91

	DESC TOTAL NET REQUISITIONS					
	<u>FY 86</u>	<u>FY 87</u>	<u>FY 88</u>	<u>FY 89</u>	<u>FY 90</u>	<u>FY 91</u>
OCT	300,213	286,231	292,296	245,402	258,375	236,908
NOV	293,295	246,587	257,620	284,685	232,528	225,017
DEC	280,576	261,598	261,672	262,081	260,312	237,697
JAN	302,538	268,786	240,696	256,063	274,854	248,456
FEB	291,305	265,829	263,323	251,186	249,794	254,712
MAR	334,946	327,027	300,761	306,555	284,882	246,253
APR	314,122	312,009	274,997	279,988	262,546	
MAY	298,578	283,629	262,301	263,041	243,070	
JUN	283,934	274,549	231,194	270,571	227,131	
JUL	306,432	294,477	241,042	247,797	224,885	
AUG	320,278	286,364	245,715	273,286	262,332	
SEP	289,689	310,123	278,173	273,736	146,257	
ANNUAL						
TOT.	3,615,906	3,417,209	3,149,790	3,214,391	3,026,966	1,449,043

Source: [Ref. 23:p. 1]

APPENDIX B

WINTER'S MODEL FORECASTS

Appendix B is the "Winter's Model" forecasts for October 1986 through September 1991. The model's periods 1 through 72 in the computer printout corresponds to the actual months. The "Winter's Model" formulas and notation are provided below. [Ref. 21:pp. 266-269]

FORMULAS

$$F(t) = \alpha A(t) / I(t-m) + (1-\alpha) (F(t-1) + T(t-1));$$

$$T(t) = \beta (F(t) - F(t-1)) + (1-\beta) T(t-1);$$

$$I(t) = \gamma A(t) / F(t) + (1-\gamma) I(t-m);$$

$$f(t+\tau) = (F(t) + T(t)) I(t+\tau-m);$$

$$MAD = \sum_{t=1}^n |e(t)| / n.$$

NOTATION

t: time or period (months);

τ : time after t;

m: seasonal cycle length in months;

α : first smoothing parameter;

β : trend smoothing parameter;

γ : seasonal smoothing parameter;

A(t): actual data in period t;

$f(t)$: forecast for period t ;

$T(t)$: trend for period t ;

$F(t)$: smoothed value for period t ;

$I(t)$: seasonality index for period t ;

$e(t)$: error for period t , which is $f(t) - A(t)$.

Winter's model for DESC REQS						Page: 1
Period	Act. Demand	F(t)	T(t)/W(t)	I(t)	Forecast	Error
1	300213			+ .996308		
2	293295			+ .973349		
3	280576			+ .931139		
4	302538			+ 1.00402		
5	291305			+ .966745		
6	334946			+ 1.11158		
7	314122			+ 1.04247		
8	298578			+ .990882		
9	283934			+ .942283		
10	306432			+ 1.01695		
11	320278			+ 1.06290		
12	289689	301326	0	+ .961382		
13	286231	297115	-210.508	+ .988073	300213	+13982
14	246587	283835	-864.000	+ .947204	288992	+42405
15	261598	282363	-894.404	+ .929969	263485	+1887
16	268786	277341	-1101	+ .995307	282601	+13815
MAD = 14129 MSE = 356E06 Bias = 1746 a = 0.300 b = 0.050 c = 0.250						

Winter's model for DESC REQS							Page: 2
Period	Act. Demand	F(t)	T(t)/W(t)	I(t)	Forecast	Error	
17	265829	275860	-1120	+965968	267054	+1225	
18	327027	280578	-827.879	+1.12507	305394	-21633	
19	312009	285615	-534.658	+1.05495	291631	-20378	
20	283629	285428	-517.279	+991586	282481	-1148	
21	274549	286847	-420.452	+945994	268467	-6083	
22	294477	287370	-373.306	+1.01889	291281	-3196	
23	286364	281723	-636.975	+1.05129	305048	+18684	
24	310123	293534	-14.5593	+985165	270231	-39892	
25	292296	294211	+20.0124	+989427	290019	-2277	
26	257620	287556	-313.765	+934377	278697	+21077	
27	261672	285482	-401.737	+926626	267126	+5454	
28	240696	272106	-1050	+967622	283743	+43047	
29	263323	271519	-1027	+966930	261831	-1492	
30	300761	269542	-1075	+1.12276	304321	+3560	
31	274997	266129	-1192	+1.04955	283220	+8223	
32	262301	264814	-1198	+991317	262708	+406.813	
MAD = 14129 MSE = 356E06 Bias = 1746 a = 0.300 b = 0.050 c = 0.250							

Winter's model for DESC REQs							Page: 3
Period	Act. Demand	F(t)	T(t)/W(t)	I(t)	Forecast	Error	
33	231194	257849	-1486	+ .933652	249379	+18185	
34	241042	250426	-1783	+1.00480	261206	+20164	
35	245715	244168	-2007	+1.04005	261396	+15681	
36	278173	254221	-1404	+1.01243	238569	-39604	
37	245402	251380	-1476	+ .986126	250145	+4743	
38	284685	266336	-654.066	+ .968006	233505	-51180	
39	262081	270828	-396.797	+ .936895	246188	-15893	
40	256063	268691	-483.791	+ .963967	261675	+5612	
41	251186	265678	-610.247	+ .961561	259338	+8152	
42	306555	267459	-490.697	+1.12861	297607	-8948	
43	279988	266909	-493.659	+1.04941	280195	+207.313	
44	263041	266094	-509.712	+ .990619	264102	+1061	
45	270571	272849	-146.502	+ .948152	247963	-22608	
46	247797	264875	-537.844	+ .987482	274012	+26215	
47	273286	263865	-561.480	+1.03897	274925	+1639	
48	273736	265425	-455.392	+1.01715	266576	-7160	
MAD = 14129 MSE = 356E06 Bias = 1746 a = 0.300 b = 0.050 c = 0.250							

Winter's model for DESC REOS							Page: 4
Period:	Act. Demand:	F(t)	T(t)/W(t):	I(t)	Forecast	Error	
49	258375	264082	-499.784	+ .984192	261293	+2918	
50	232528	256571	-850.314	+ .952577	255149	+22621	
51	260312	262358	-518.451	+ .950722	239584	-20728	
52	274854	268826	-169.130	+ .978581	252405	-22449	
53	249794	265994	-302.293	+ .955945	258330	+8536	
54	284882	261710	-501.395	+1.11859	299863	+14981	
55	262546	257901	-666.752	+1.04156	274115	+11569	
56	243070	253676	-844.691	+ .982513	254821	+11751	
57	227131	248847	-1044	+ .939297	239722	+12591	
58	224885	241783	-1345	+ .973140	244701	+19816	
59	262332	244055	-1164	+1.04795	249807	-12525	
60	246257	242655	-1176	+1.01657	247056	+798.844	
61					237662		
62					228907		
63					227344		
64					232855		
MAD = 14129		MSE = 356E06	Bias = 1746	a = 0.300	b = 0.050	c = 0.250	

Winter's model for DESC REQs						Page: 5
Period:	Act. Demand:	F(t)	T(t)/W(t):	I(t)	Forecast :	Error
65					226345	
66					263541	
67					244167	
68					229169	
69					217985	
70					224695	
71					240735	
72					232332	
MAD = 14129 MSE = 356E06 Bias = 1746 a = 0.300 b = 0.050 c = 0.250						

APPENDIX C

PHONE SURVEY

Appendix C is the result of a phone survey the author conducted to determine if there might be an economically feasible fixed order charge for DESC to consider. Various private industries that warehouse and ship material to customers were surveyed to ascertain the handling and shipping costs they pass on to their customers. These handling and shipping costs are all added to the price a customer pays for the actual material ordered. The results of the survey are as follows:

L.L. BEAN, a retail mail-order house specializing in camping equipment and clothing.

For the first time in the history of the company they have instituted a set shipping and handling charge. L.L. Bean now charges \$3.50 on all customer orders regardless of the total dollar amount of the order. All regular shipments are sent via U.P.S. If a customer desires a quicker delivery an additional \$8.50 is charged. The resulting total shipping and handling charge is then \$12.00.

MICROSOFT, a manufacturer and distributor of computer software.

The company charges a flat \$7.83 per order originating out of their Brothell, Washington customer warehouse. Delivery is second day air via Federal Express.

CRATE AND BARREL, a mail order house specializing in house hold goods.

The handling and shipping charges are variable based on the weight and volume of the shipment. The charges range from \$2.00 to \$19.00 and U.P.S. was the normal mode of shipment. For an additional \$5.00 shipments that weren't classified as heavy or bulky would be sent via Federal Express.

SPIEGEL, a mail order house specializing clothing and house hold furnishings.

A specific handling charge of \$1.95 was added to each order and then the actual U.P.S. shipping charges were added based on the weight, destination and desired delivery date of the shipment.

SEARS, the largest retailer and one of the oldest mail order houses in the United States.

A variable handling and shipping charge is added to all orders based on the following variables: distance from local Sears store, distance from catalog center warehouses, and weight of the order. Sears uses various modes of shipment, including company owned trucks, U.P.S., and parcel post and regular mail shipment. The minimum handling and shipping charge for an order regardless of the shipment mode is \$2.85.

DAMARK, a mail order house specializing in electronics, house-hold items and novelty items.

The handling and shipping charges are printed in their catalog beside the description of the item. Relatively small items were shipped via Federal Express and the larger items were shipped via U.P.S. The minimum charge for a item is \$4.00.

MAIL ORDER MALL, a mail order house specializing in house-hold and novelty items.

The handling and shipping charges are printed in the catalog beside the description of the item. All orders are shipped via Federal Express and the minimum handling and shipping charge is \$4.00.

CHADWICK'S OF BOSTON, a mail order house specializing in women's apparel.

The handling and shipping charges are based on the total sales price of the order. The charges are provided below:

<u>TOTAL MERCHANDISE PRICE</u>	<u>SHIP/HAND CHARGE</u>
\$.00-25.00	\$4.00
\$25.01-50.00	\$5.50
\$50.01-75.00	\$6.75
\$75.01-125.00	\$7.50
\$125.01 & UP	\$8.00

All orders are shipped via U.P.S. unless express delivery is requested. An additional \$5.50 is added for express shipment via Federal Express.

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Thesis

A273 Ahern

c.1 Allocating the increased
operational costs in re-
tail prices at the De-
fense Electronics Supply
Center as a result of
Defense Management Report
Decision 901.



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